

ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 1]

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I.—THE BRITISH SPECIES OF CYTOSPORA.

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If one finds in a dead or dying branch a number of little dark-coloured pustules, each about half a millimetre or so broad, which at first raise the surface in a conical or convex cushion and at length burst it at the summit, protruding a little roundish disc, of any colour from pure white to dingy-brown, in the midst of which is a black point, and if in moist weather there exudes from the black point a whitish, yellowish, or reddish tendril of spores—the inference is that there lies before one a fungus of the form-genus *Cytospora*.

The members of this genus of the Coelomycetes have spores very similar to those of *Naemospora*, but can be distinguished from them by the possession of an obvious pycnidial wall (seen on cutting a section), usually of a dark-grey or olive-brown colour, whereas *Naemospora* has no pycnidial wall, merely a basal proliferous stratum, and is generally of a lively yellowish or reddish colour. There is another genus, *Libertella*, similar to *Naemospora*, but having falcate and longer spores, over 10 μ . If one overlooks these distinctions, it is easy to go astray, for the tendril alone is no mark of a *Cytospora* or a *Naemospora*.

For example, there is a fungus recorded under the name "*Naemospora crocea* Pers." as having been found on coniferous trunks at Alnwick, during the 1907 foray of the British Mycological Society. But, though yellow tendrils are abundant, the specimen on sectioning is seen to have thick dark enclosing walls to all of its many chambers. It is really *Cytospora Kunzei* Sacc. Other similar instances abound in mycological literature.

The pycnidial chambers, or chamber, of *Cytospora* always arise in a stroma (sometimes, however, nearly obsolete), composed of a more or less grumous mass of mycelial cells. Each chamber is lined on every side by a crowded stratum of spore-pedicels, sometimes branched, which bear the spores singly at

their apices. These spores are, in probably every species, of a characteristic shape, called "sausage-shaped," viz. cylindrical, slightly curved, with more or less rounded ends. This shape is also met with not only in the spores of *Naemospora*, but in the ascospores of *Valsa* and the allied *Pyrenomyces*.

Cytospora was originally defined by Ehrenberg in *Sylv. Berol.* p. 28 (1818), as follows:—

"Sporangium membranaceum aut grumosum ostiolo instructum, includens massam sporuloso-gelatinosam demum (sæpe cirrurum aut globulorum forma) erumpentem."

The stroma, varying from 0.25 to 2 mm. in diameter, is covered by the epidermis or periderm which it usually raises convexly; sooner or later it becomes erumpent, conical or pustular, enclosing one or more chambers (pycnidia), which are often imperfectly separated and irregular or sinuous in shape (loculi), but are sometimes distinct, more or less circinating and occasionally arranged round a central chamber or a black columella. When the stroma is exposed by the bursting of the covering layer, a disc is seen in which there are one or more black pores; occasionally the stroma contains only one loculus, but if there are several they may still open by a common central pore, or by separate apertures. The spores are always small (varying from 3 to 10 μ in length), often very numerous,* nearly or quite hyaline, and in a damp atmosphere they issue from the pore in a slender curling tendril,† which may be caused by greater moisture to coalesce into a globule or to sink into a formless mass. As the tendril collapses, the colour of the spore-mass always gets deeper in tint. The colour mentioned in the descriptions is that of the freshly exuded tendril. Whether the spore-mass assumes the shape of a globule or a tendril, depends upon the moisture of the atmosphere rather than upon the nature of the fungus.

The spores are frequently described as "straight or curved," but this is nearly always an illusion due to the different postures in which they are seen. If a single spore, of the ordinary sausage shape, is watched while moving in water under a microscope, it may be seen to pass through three phases, as it presents itself in the three planes of space: like many *Diatoms* and *Desmids*, it has a (curved) profile-view, a (straight) face-view, and a (circular) end-view. The same statement is true of the spores of many *Dasycephale* and other small *Pezizeae*, and the same mistake is often made in the description of them.

The members of the form-genus *Cytospora* are probably all pycnidial stages (or "spermogones") of those *Pyrenomyces* which have sausage-shaped spores, such as *Valsa*, *Valsella*, and

* Rostrup reckoned the number of spores in a single pustule of *Cytospora Pini* to be over 400 millions, and this is no exaggerated estimate.

† If the material is in good condition and not too old, but without tendrils, the spores can be caused to exude by placing the lower end of the stick in tepid water, or by merely putting a drop of water on the bark.

Eutypella.* They are so similar that some of them (in the absence of the ascophorous stage) can scarcely be distinguished from one another, unless it be by the colour of the tendril, especially when they are said to occur on hosts belonging to several different genera. Many, but not all, of these latter allegations no doubt refer to collective species (biologically, at least, distinct), but some of them are merely inherited from the past and are the result of confused identification or desultory examination. Occasionally the perfect (ascophorous) stage may be found, if looked for, in close company with the pycnidial stage, in which case there may be no uncertainty. When both occur, it sometimes happens that the *Cytospora*-stage has been parasitic, and is succeeded by the mature ascophorous stage on the dead host. The two forms of fruit are more rarely produced simultaneously, though of course their periods may overlap.

When more is known about them (but the time is not yet), the species may perhaps be separated into two sections, following von Höhnelt in *Annal. Mycol.* 1918, p. 130 :—

(i) *Eucytospora* (belonging to *Valsa* proper, *Euvalsa* Nits.), not possessing a special basal stroma, so that the pycnidial chambers are merely immersed in the little changed matrix; e.g. *C. Abietis*, *C. ambiens*, *C. Capreae*, *C. ceratophora*, *C. chrysosperma*, *C. Curreyi*, *C. germanica*, *C. leucosperma*, *C. Pini*, *C. pruinosa*, *C. Rosarum*, *C. Salicis*.

(ii) *Leucocytospora* (belonging to *Leucostoma*, *Eutypella* and *Valsella*), provided when mature with a special basal stroma, which usually shows as a dark line underlying and surrounding the loculi, and delimiting the part occupied by the stromatic mass from the other more or less unchanged matrix; e.g. *C. cincta*, *C. Kunzei*, *C. guttifera*, *C. leucostoma*, *C. nivea*, *C. Prunorum*, *C. rubescens*. When this basal stroma is well-marked and closely adherent, it forms what Fries called the "conceptacle," but not infrequently it is at some distance from the loculi; moreover this possession of a "conceptacle" seems to be dependent, to a certain extent, upon the circumstances of growth, and cannot always be trusted as a guide.

In examining a *Cytospora*, in order to decide this and other points, sections should be cut (preferably, as Diedicke recommends, but not necessarily, with a dry razor) both vertically and horizontally at different levels. For the latter purpose the pustules may be best cut *in situ*. It must be remembered that, unless one can find the *Valsa* and the *Cytospora* growing in intimate association as in *C. germanica*, or can cultivate the one from the other, the naming of some of the *Cytosporas* may still involve an element of doubt. Since the fungi belonging to this group cause a considerable amount of disease, especially in fruit trees, and do so chiefly, if not entirely, in their pycnidial stage, the

* It will be seen that, of the species recorded below, exactly one-half have an ascophorous stage assigned to them, though in several cases with considerable doubt; for the other half, there is as yet no clue.

difficulty of naming would be a serious disadvantage, if it were not that the same remedies can be applied in nearly every case. There is great room for experiment in the artificial culture of these economically important fungi by those who have time and facilities placed at their disposal in the phytopathological institutions now so numerous, and it is strange that (with two or three exceptions) so little work has been done in this direction by professional mycologists. Still, when the host is known, there are certain characteristics of most of the species which will lead to a probable conclusion, and this may be converted into certainty by discovering the *Valsa*-stage.

In conclusion, perhaps it will be permissible to recount two experiences among my own which will illustrate what sort of evidence can be obtained without test-tubes or pure cultures. When one says that the *Cytospora* and the *Valsa* occur together, that in itself goes for little, or is at best only suggestive, as every one would admit; it is the way in which they occur together that is convincing.

First example :—In the summer and autumn of the year 1918, the fungus which is described below as *C. Oxyacanthae* was extremely common round Birmingham on hawthorn cuttings left lying in ditches and on the hawthorn stakes driven into the ground by the hedgers to support the pleached hedges. Mr. D. A. Boyd reported to me exactly the same state of things in the south-west of Scotland. By continuing to look in suitable places, at last, in March and April, 1919, I came across a number of branches which yielded ascospores dispersed among the still remaining *Cytospora* pustules, and when once seen they could be found elsewhere in similar positions and in great quantity. It was a disappointment that the ascophorous stage turned out to be hardly distinguishable from normal *Valsa ambiens*, and could at most be considered only one of the forms into which that collective species will have to be subdivided. But of the genetic connection between the two stages no one who had observed the facts could have had the slightest doubt. One could constantly find the *Cytospora* pustule surrounded by a ring of perithecia whose mouths bordered the disc.

Second example :—In a large park, which need not be further particularised, numbers of poplar trees of various species were thickly covered, especially on the smaller branches, with the orange-yellow tendrils of *Cytospora chrysosperma*. Many of the trees (some young) were obviously dying, and one of them (about twenty feet high), which was most severely attacked, was already nearly dead. When the top of this was lopped off, it was found that the main stem, a little over one inch in diameter, was completely occupied for about four feet by a crowd of *Valsa* pustules. These on examination were seen to be *Valsa sordida*, the branches of the lopped portion and the upper part of it being as thickly covered by the *Cytospora*. If the top part of the tree had not been lopped off, the *Valsa*-stage might easily have escaped observation. Here, again, there could be no faintest doubt of

the connection of the two stages in the mind of any one who saw the tree : the proof was as conclusive to the observer as any that could be given by artificial cultures, and even more so than some.

ALPHABETICAL LIST OF SPECIES.

C. Abietis Sacc. Syll. iii. 269. Allesch. vi. 573. Diedicke, Pilz. Brand. p. 329. *C. Pini* Fekl. p.p.

Stromata 500–750 μ diam., convex, with a thick round truncate neck, disclosing a grey or yellowish disc, which afterwards becomes brownish-black and is pierced by a single flat open pore (rarely two), multilocular within, the loculi very minute and densely crowded without order. Spores* 5–6 \times 1 μ (3–4 \times 1 μ , Sacc.), issuing in dingy yellow masses; sporophores subulate, 12–16 μ long, verticillately branched (sparingly branched, Sacc.)

On small branches of *Larix europaea*. Eastham Wood, Cheshire (Ellis). Dec. Said to be the pycnidial stage of *Valsa Abietis* Nits; in other countries it is recorded also on *Picea* (*Abies*) *excelsa*, and on *Sequoia*.

Distrib. Europe generally.

C. Ailanthi Berk. & Curt. North Amer. Fungi. no. 3432; Grevill. ii. 99. Sacc. Syll. iii. 277.

Stromata rather crowded, 250–300 μ diam., totally immersed, then bursting the epidermis by a minute pore and disclosing a blackish disc, but scarcely prominent. Spores 5–6 \times 1 μ .

On twigs of *Ailanthus glandulosa*. Kew Gardens (Cooke). Apr.

The specimens are young and somewhat doubtful. Not the spermogone of *Eutypella Ailanthi* Sacc., for that is said to be *Cytosporina Ailanthi* Sacc., with spores 15 μ long.

Distrib. United States of America.

C. ambiens Sacc. Syll. iii. 268. Allesch. vi. 567. Died. p. 332.

Stromata subgregarious or densely scattered, 0.5–1 mm. diam., conico-depressed, often extending along a whole branch, covered, then erumpent, blackish-grey, with a roundish flat disc which is paler or brownish, but never white except at first; ostiole black, usually one only, scarcely protruding; loculi several, but often confluent into one, the walls composed of dark brownish tissue. Spores 5–7 \times 1 μ , exuding in a white, then yellowish mass; sporophores often much branched, 20–30 μ long, branches forked or verticillate, acicular.

On bark of twigs and branches of *Acer*, *Betula*, *Castanea*, *Corylus*, *Cotoneaster*, *Fagus*, *Fraxinus*, *Pyrus*, *Rosa*, *Rubus*, *Quercus*, *Ulmus*, etc. Oct.–May. Very common, but no doubt

* In the descriptions which follow, the spores are always to be taken as sausage-shaped, unless some other term is applied to them. All the species recorded have been examined, except where "(n.v.)" is added, but in several cases the specimens were too poor or too scanty to permit of certainty.

a collective species; the pycnidial stage of *Valsa ambiens* Sacc., which constantly occurs with it, and which is also a collective species varying much on the different substrata.

Recorded abroad also on *Alnus*, *Carpinus*, *Cornus*, *Populus*, etc. The prominent disc is almost always round, and varies in colour from white through grey to black; the spores are very variable, from 4 to 7 μ in length, with sporophores from 10 up to 30 μ .

The fungus gets its name from the fact that the numerous black ostioles of the perithecia of the *Valsa* stage are often arranged in the form of a ring (i.e. circum-ambient) just within the periphery of the disc. The form on *Betula* may belong to *Valsa betulina* Nits. and besides that other forms on *Crataegus*, *Rubus*, *Tilia*, etc., may be distinguished: see *C. Oxyacanthae*, *C. carphosperma*, and *C. leucosperma*, all of which have been included by various authors under *C. ambiens*. The chief mark of the collective species seems to be the at length dingy disc, the much branched sporophores, and the colour of the tendrils. The latter is white at first, not pure white, but opaline white, the white of "London" milk or of opal gas-globes, changing sooner or later to a yellow of varying intensity; but there seems always to reside in the yellow a turbidity which gives it a peculiar character, perhaps that implied by Lind when he calls the tendrils of *C. ambiens* on *Fraxinus* "olivaceous."

Distrib. Europe, North and South America.

C. Ampelopsidis *C. Massal.* Contr. Mic. Ver. p. 86, pl. 2, f. 12. Sacc. Syll. x. 243. Allesch. vi. 569.

Stromata scattered, somewhat oval, longitudinally placed, flattened-convex, black, 400–600 μ long, nestling in the cortex and for a long time entirely concealed by it, at length disclosing an oval blackish disc, marked with several minute non-projecting pores, multilocellate within, the loculi small and varying much in shape and arrangement, separated by thick dark brown walls. Spores 5–6 \times 1–1.5 μ , in mass nearly (but not quite) colourless; sporophores crowded, parallel, rod-shaped, usually very erect and straight, 15–18 \times 1 μ .

On twigs of *Ampelopsis hederacea*. Kirkby, Lancs. (Ellis). June. Distinguished from *C. Vitis* Mont. by being all but completely concealed by the outer tissues. Massalongo says that the tendrils are "pinkish when moist, reddish-amber when dry."

Distrib. Germany, Italy.

C. annulata *Ell. & Ev.* in Proc. Acad. Nat. Sci. Philad. 1893, p. 160. Sacc. Syll. xi. 508.

Stromata immersed, multilocular, about 1 mm. diam. slate colour within, with a ringed ostiole. Spores 5–6 \times 1–1.25 μ , "oblong."

On dead branches of *Acer Negundo*, Kew Gardens (Cooke).

When perfectly developed, as seen in American specimens, this presents a remarkably ringed appearance. The black

shining ostiole is surrounded by a narrow ring of whitish stroma; around this is the conspicuous torn margin of the epidermis, and in many cases the whole is surrounded by a wide zone in the form of a dark-brown stain.

Distrib. North America.

C. Aquifolii Fr. in Duby, Bot. Gall. ii. 725. Sacc. Syll. iii. 274. Allesch. vi. 583.

Stromata subgregarious, conical, up to 500 μ diam., black, surrounded by a black stain, covered, then erumpent by a rimose or stellate fissure and disclosing a small very dark-coloured disc, with a central prominent very black pore which often nearly obliterates the disc, plurilocular within; the loculi small, roundish, and clustered in a circular group; no conceptacle; walls of loculi very thick and blackish-brown. Spores 4-6 \times 1 μ ; sporophores simple, subulate, about three times as long as the spore, tinged olivaceous at the base.

On dead branches and twigs of *Ilex Aquifolium*. Kew Gardens; Harborne & Quinton, near Birmingham. Mar., Apr.

These specimens differ from *C. ilicina* Sacc. (*ibid.*, p. 274), the spermogone of *Valsa Aquifolii* Nits., in the total absence of a conceptacle (*cf.* Nitschke, Pyr. Germ., p. 231), as well as in the smaller spores. The bases of the pycnidia are simply embedded in the cortex. The centre of the pustule, before it bursts, is marked with a whitish dot (from the loosened epidermis) and afterwards the disc is surrounded by the pale upturned edge and the black zone, so that it often presents a distinctly annulated appearance that reminds one of *C. annulata*.

Distrib. France, Germany.

C. atra Sacc. Syll. iii. 257. Allesch. vi. 586. Died. p. 348. *Lamyella atra* Bon. Abhandl. ii. 134, pl. 2, f. 15.

"Stromata small, covered, then erumpent, black without, pallid within, distinctly plurilocular, the chambers ending in a rather prominent dark-coloured disc, and each provided with a separate roundish pore. Spores cylindric-oblong, sausage-shaped, very minute; sporophores rather long, branched."

On dry branches of *Morus alba*. Kew Gardens (Cooke). Distinguished chiefly by its separate ostioles. (*n.v.*)

Distrib. Germany, Denmark, India.

C. Capreae Fckl. Symb. Myc. p. 199 (1869). Sacc. Syll. iii. 262. Allesch. vi. 605. Died. p. 361. *C. Schweinitzii* Sacc. Syll. iii. 261 (1884). Allesch. vi. 602.

Stromata gregarious, conico-truncate on a rounded base, 500-750 μ diam., somewhat prominent, erumpent through the periderm and surrounded by its torn edge, or (if the easily loosened periderm is thrown off) standing free on the brownish surface of the inner bark (cortex), attenuated into a thick neck which is pierced by a rather broad pore, usually one-chambered or with several spurious

loculi which are rather large and radiately disposed, filled with a greyish mass; no conceptacle. Spores $4-5 \times 1 \mu$, issuing as an olivaceous amber-coloured tendril; sporophores simple or branched at the base, $20-28 \times 1 \mu$.

On bark of *Salix Caprea*, *S. fragilis*, *S. petiolaris*, etc., Kew Gardens. The pycnidial stage of *Valsa Schweinitzii* Nits. Saccardo appears to have conferred his specific name on it in oversight of Fuckel's prior name.

Distrib. Germany, Austria, Italy, Algeria.

C. carbonacea Fr. Syst. Myc. ii. 544. Sacc. Syll. iii. 260. Allesch. vi. 610. Died. p. 366.

Stroma proper rather thin; loculi black and becoming indistinct together with the whitish disc; ostioles prominent, black.

On branches of *Celtis occidentalis*. Kew Gardens (Cooke). The specimens are somewhat doubtful, and imperfect, but they are not *C. Celtidis* Ell. & Ev.

"A species of which little is known, though it is very common; provided with a proper conceptacle; pustules minute, not prominent, immersed in the inner bark; stroma proper carbonaceous, indistinctly divided into chambers, but there is a very distinct central columella." (Fr., on *Ulmus*.)

Diedicke, who finds it on Elm in Germany, describes it as follows:—"Stromata loosely gregarious, raising the epidermis at length considerably, and bursting it with the whitish disc, flatly conical, up to 1.5 mm. broad, of dark olivaceous texture; many incomplete radiating chambers arranged round a central columella with a common ostiole. Spores $4-5 \times 1.5 \mu$; sporophores simple, filiform, up to $15 \times 1 \mu$, soon vanishing."

Distrib. Belgium, Holland, Germany, Sweden, North America. Recorded also on *Alnus*.

C. carphosperma Fr. Syst. Myc. ii. 543. Cooke, Handb. pp. 462, 826. Sacc. Syll. iii. 274. Allesch. vi. 588. Died. p. 351.

Pustules gregarious, depressed-conical, 0.5-1 mm. broad, stroma often little and indistinct; loculi circinating, black; disc round, of a dingy whitish colour, with usually a single central black ostiole (but sometimes two). Spores $5-6.5 \times 1-1.5 \mu$, issuing in a pale-yellow, then deeper yellow tendril; sporophores simple or verticillately branched, acicular, $15-20 \times 1.5 \mu$.

On bark of species of *Tilia*. England, Scotland, Ireland; not uncommon. Winter and spring. The pycnidial stage of an undetermined species of *Valsa*.

The freshly exuded spore-mass has the colour of dry wheat straw, *κάρφος*; that is the only mark apparently that will distinguish this from *C. ambiens*. It is recorded sometimes on *Pyrus*, e.g. in Scott. Nat. 1887, p. 127, on *Pyrus communis* and *P. Aucuparia*, but I think wrongly. There are two possibilities, (1) the *Valsa* to which it belongs may be indistinguishable from others included under *V. ambiens*, or (2) it may be distinct.

Among a specimen on twigs of *Tilia* from Scotland, I found a *Valsa* with much smaller spores than *V. ambiens*: asci $40-50 \times 7-8 \mu$, spores $12-12.5 \times 2.5-3 \mu$. Therefore the latter case is probable, and it will be best *ad interim*, in the absence of cultural proof, to confine the name *carphosperma* to the form on *Tilia*, placing those on *Pyrus* under *C. ambiens* or elsewhere.

Distrib. Europe generally.

C. ceratophora Sacc. Syll. iii. 268. Allesch. vi. 572. Died. p. 342.

Stromata densely scattered, pustular, depressed-conical or convex, $500-750 \mu$ diam., covered, then erumpent by a very small grey disc marked with a single black ostiole, plurilocular, with dark-olive contents; pycnidial walls several cells thick, of narrow olivaceous prosenchymatous cells; no conceptacle. Spores $4-5 \times 1 \mu$; sporophores simple or verticillately branched, acicular, $20-50 \times 1 \mu$.

On branches of *Castanea*, *Quercus*, *Ulmus*, etc. Kew Gardens; Middlesex; Warwickshire; Cheshire; Ayrshire, etc. Sept.-Nov. The pycnidial stage of *Valsa ceratophora* Tul.

The Warwickshire specimens were in company with a beautiful series of *V. ceratophora*, on dead shoots of the previous summer, sent up from the stool of a felled oak, Earlswood, Sept. 1917. These shoots had prematurely died owing to a severe attack of the oidial stage of *Microsphaera alphitoides* Griff. & Maubl., following on defoliation in the spring by larvæ of *Tortrix viridana*. On the Continent this *Cytospora* is recorded also on *Carpinus*, *Fraxinus*, *Rosa* (*C. Rosæ* Fckl.), *Sorbus*, etc., etc. Lind assigns to it "olivaceous tendrils."

Distrib. Europe generally.

C. chrysosperma Fr. Syst. Myc. ii. 542. Cooke, Handb. pp. 462, 822. Sacc. Syll. iii. 260. Allesch. vi. 591. Died. p. 353. *Naemospora chrysosperma* Pers. Syn. p. 108.

Stromata somewhat scattered, often flattened, but sometimes acutely conical, up to 2 mm. wide, covered, then erumpent by a cinereous-black disc, olivaceous-cinereous within; walls of loculi thick, very dark, subsclerotial, parenchymatous; loculi often irregular, no distinct conceptacle. Spores $4-5 \times 1 \mu$, issuing in long, large, copious, golden or yellow tendrils; sporophores filiform, somewhat branched, $10-15 \times 1 \mu$.

On living and dead bark of species of *Populus* (*P. alba*, *balsamifera*, *deltoides*, *nigra*, *serotina*, *tremula*, etc.) England, Scotland, Ireland; very common. May-Sept. The pycnidial stage of *Valsa sordida* Nits.

It causes a serious disease of Poplars in this country, and even more so in the United States, where great attention is directed to it. The *Cytospora* stage flourishes best during a wet summer, and then in the autumn the *Valsa* stage may be found in plenty on the thicker branches. When at its best, the stromata

look like a row of little volcanoes; the extruded spore-masses become deep amber in colour.

Distrib. Europe, North America, India.

Cytospora populina Rab. (*Naemospora populina* Pers. Sacc. Syll. iii. 747; Allesch. vii. 541) assumes a larger and clumsier form; it is said to have larger spores ($8 \times 1.5 \mu$), and to belong to *Valsa populina* Sacc., but it is not known as British.

C. cincta Sacc. Syll. iii. 254. Allesch. vi. 593. Died. p. 356.

Stromata aggregated, rather large, pustular, usually transversely erumpent, often with a number of perithecia surrounding the single central pycnidium; disc dingy-white or even brownish, mostly with a single ostiole; loculi of pycnidium one or few, rarely numerous and more or less radiating. Spores $6-8 (4-9) \times 1.5-2 \mu$, issuing in pale reddish tendrils; sporophores filiform, slender, usually simple, $10-15 \times 1 \mu$, rising from a thick brown parenchymatous wall.

On *Prunus Cerasus*, *P. domestica*, *P. spinosa*. Near Cambridge, Sutton Coldfield, and other places, but the specimens were all ill-developed. Spring. The spermogone of *Valsa cincta* Fr.

This species is common in Germany, and a variety is recorded on *Pyrus*. When fully developed, it is easily recognised by its ring of protruding perithecial ostioles on the disc, surrounding a central one belonging to the pycnidium. The mature stroma may measure as much as 2-3 mm. in diameter. Diedicke records it on *Prunus Padus*.

Distrib. France, Holland, Germany, Sweden.

C. clypeata Sacc. Syll. iii. 252. Allesch. vi. 600. Died. p. 360

Pycnidia scattered or sometimes in short longitudinal rows, $0.5-1$ mm. diam., at first globose, bullate, covered, then splitting the epidermis longitudinally, at length conical, shining-brown outside, emergent and showing a small round dingy disc which finally becomes black and hard by the formation of a little dark mass of dense shining subcarbonaceous tissue around the ostiole of the subunilocular pycnidium; walls of pycnidium firm, rather thick, and brownish olive, of mixed parenchyma and prosenchyma. Spores about $6 \times 1 \mu$; sporophores filiform, $10-15 \times 1 \mu$.

On dead branches of *Rubus fruticosus*. Harborne and Kingswood, near Birmingham. Mar.-Apr. The pycnidial stage of *Valsella clypeata* Fekl. These specimens agree with Sydow, Mycoth. germ, no. 1709!

Distrib. Holland, Germany.

C. Curreyi Sacc. Syll. iii. 269. Allesch. vi. 573. Died. p. 330. Lind, in Annal. Mycol. 1907, v. 275.

Stromata conico-truncate or almost hemispherical, with a round or rarely oval base, $1-1.5$ mm. diam., very protuberant, covered at the sides by the adherent stellately cleft periderm, with a dingy-brown disc provided with a single central papilla

which is pierced by a very minute pore (sometimes there are two or three papillæ), multilocular within, the numerous loculi arranged radiately or without order. Spores $3-6 \times 1.5 \mu$; sporophores usually simple, rarely branched, 20-24 or even 32μ long.

On dead branches of *Larix europaea*, Roslin Glen and Forres (Boyd). Also on dead branches and cone-scales of *Picea*, *Pinus*, etc., not uncommon. The pycnidial stage of *Valsa Curreyi* Nits. Lind (*l.c.*) says "issuing in purple tendrils."

Distrib. France, Germany, Italy, Denmark.

C. Euonymi Cooke, in Grevill. xiv. 4. Sacc. Syll. x. 244. Allesch. vi. 580. Died. p. 341.

Stromata densely gregarious, covering large portions of the bark, rather small, at length blackish and shining, raising the browned epidermis conically, divided within into several irregularly arranged chambers, which converge into a common cavity, and emerge as a conical ostiole. Spores $5-7 \times 1-1.5 \mu$; sporophores crowded, mostly simple, $15-25 \times 1 \mu$.

On small twigs of *Euonymus americanus*, Kew Gardens (Cooke). On dead twigs of *Euonymus japonicus*, Hunterston, Ayrshire (Boyd). On dead branches of *E. japonicus*, Wisley, Surrey. Sept.

The tendrils are stated to be "pallid." Cf. *Cytospora foliicola* and *Ceuthospora euonymi* Grove (Journ. Bot. 1916, p. 190).

Distrib. Germany.

C. foliicola Lib. Exs. no. 64. Desm. in Ann. Sci. Nat. 1842, xvii. 117. Cooke, Handb. p. 754. Sacc. Syll. iii. 275. Allesch. vi. 567. Died. p. 332.

Stromata gregarious, about 350 mm. diam., covered by the epidermis, then erumpent, conico-depressed, black, containing few loculi; disc pallid, with a common central pore. Spores " $7 \times 1 \mu$," issuing as a whitish tendril; sporophores filiform, equal, fasciculate, about 10-15 (or more) $\times 1 \mu$.

On fallen leaves of *Hedera Helix*, Kew Gardens. On fading (not dead) leaves and small twigs of *Euonymus japonicus*, Sefton Park, Liverpool (Ellis) and Kew Gardens. March, etc.

This species has been much confused; all those specimens which I have seen on leaves of *Vinca* belong to *Ceuthospora Feurichi* Bubak, and many of those on *Euonymus* to *Ceuthospora Euonymi* Grove. It is nowhere common, but is recorded also on the Continent on leaves of *Acer*, *Crataegus*, *Quercus*, *Smilax*, etc. It is quite possible that all these are only leaf-forms of those species of *Cytospora* which occur on the branches and twigs: e.g. when on leaves of *Euonymus* it is possibly merely a form of *Cytospora Euonymi* (q.v.). The variable size of the spores given in books, "up to 12μ ," is probably a result of this confusion, for on *Euonymus* leaves they measure only 4-6 μ .

C. Friesii Sacc. Syll. iii. 269. Allesch. vi. 574. Died. p. 330.

Stromata scattered, small, conico-truncate, bursting through the epidermis by the blackish-grey disc which is pierced by one

or two slightly projecting ostioles; loculi few, circinating. Spores $4.5 \times 1.5 \mu$; sporophores fasciculate, mostly simple, $10-15 \times 1 \mu$.

On leaves and twigs of *Picea*. Not known with certainty as British, but extremely likely to occur here. The spermogone of *Valsa Friesii* Fekl.

It is found especially on the upper surface of the leaves, but also on the young twigs. The ascophorous stage follows on the main trunk and branches. Often included under *C. Pinastri* (q.v.).

Distrib. France, Belgium, Germany.

C. Fuckelii Sacc. Syll. iii. 263. Allesch. vi. 577. Died. p. 338.

Stromata widely but not densely scattered, obtusely and flatly conical, $500-750 \mu$ broad, roundish, long covered by the epidermis, at length piercing it by the greyish disc which is marked with a black pore, multilocular within, the loculi roughly circinate, with thick walls composed of greenish-grey prosenchymatous cells. Spores $5-6 \times 1.5 \mu$; spore-mass greyish; sporophores acicular, curved, simple, $20-26 \mu$ long.

On twigs of *Corylus Avellana*. Neston, Cheshire (Ellis). Dec. In company with *Valsa Fuckelii* Nits., of which it is the spermogone.

Distrib. Germany, Italy.

C. fugax Fr. Syst. Myc. ii. 544. Cooke, Handb. pp. 462, 827. Sacc. Syll. iii. 263. Allesch. vi. 576. *Variolaria fugax* Bull. pl. 432, f. 5.

Stroma little or none. Pustules prominent, $1-1.5$ mm. broad, lens-shaped, concrete with the epidermis; loculi black, circinating round a central columella; disc flat or somewhat sunken, black or smoky-brown. Spores $6-8 \times 1.5 \mu$; tendrils slender, greyish-white, subhyaline.

On bark of *Salix* (*S. alba*, *fragilis*, *nigricans*, *viminialis*, etc.). Kew; Kent; Studley Castle, Wixford, etc., Warwickshire. Also recorded abroad on *Corylus*.

I am inclined to believe that this is not anything but the final state of *C. Salicis* (q.v.). When perfect, it consists of a circle of 6-20 black loculi, filled with a greyish mass, with almost no stroma perceptible, and forming a flattened covered pustule, up to 1.5 mm. wide, bursting through in the centre with a ragged opening. Bulliard gave it the name *fugax* because it seemed to disappear in a short time.

Distrib. Europe, Siberia, North America.

C. germanica Sacc. Syll. iii. 262. Allesch. vi. 604. Died. p. 355. Grove, in Journ. Bot. 1922, p. 45.

Stromata scattered or gregarious, conico-truncate or convex, with a roundish base, $0.5-1.25$ mm. broad; disc whitish, then cinereous, at length marked with a small black central papilla

which is pierced by a pore; loculi numerous, radiately disposed, often imperfectly divided, walls of the chambers of thick brown prosenchymatous cells. Spores $5-6 \times 1.5 \mu$; sporophores crowded, long, slender, filiform, usually simple, $20-25 \times 1-1.25 \mu$.

On dead twigs of *Salix*. Sutton Coldfield. Apr. May. On the same twigs was an abundance of *Valsa germanica* Nits. of which it is the spermogone; when the two came close together, the 6-9 erect black ostioles of the *Valsa* formed a ring round about the spermogonial disc, piercing the periderm at a distance of 0.5-1 mm. away from it. This mode of occurrence is especially characteristic of this species. The grey disc of the *Cytospora* was occasionally pierced by two papillæ.

Distrib. Germany (on *Populus*), Finland.

C. guttifera Fr. Syst. Myc. ii. 545. Cooke, Handb. p. 462. Sacc. Syll. iii. 264. Allesch. vi. 578. Died. p. 339. *Sphaeria guttifera* DC. Flor. fr. vi. 136.

"Stromata immersed, plurilocular, black, attenuated into a conical obtuse erumpent neck; gelatinous contents issuing in a whitish globule. Spores oblong-cylindrical."

On branches of *Quercus*. Berkeley says "on dead Willow twigs." Also recorded in Germany on *Corylus* and *Tilia*.

"The loculi form a black tubercle, immersed in the bark, on which is placed a neck which perforates the epidermis. Globule at length black." (Fr.)

The globule perched on a subconical neck forms the distinguishing feature of this species, if indeed it be anything but a chance collection of forms in which the weather has caused the tendril to assume the shape of a globule, as I am inclined to think. The somewhat doubtful specimens seen have pustules, up to 0.75 mm. diam., immersed in the bark and surrounded by a sunken zone: for a long time they remain covered, but at length a dark grey disc with a thick neck protrudes; within are 1-3 black loculi immersed in a cinereous-brown stroma. They are not *C. ambiens*, since they have a distinct conceptacle.

Distrib. France, Germany.

C. Harioti Briard, in Rev. Mycol. 1889, p. 16. Sacc. Syll. x. 247. Allesch. vi. 591. Died. p. 354.

Stromata scattered or loosely gregarious, not crowded, 0.5-1 mm. diam., conical on a roundish base, or if oval longitudinally elongated, olivaceous-grey, deeply immersed, long covered by the epidermis, then splitting it by a dingy-brown disc, with usually a single blackish pore; loculi several, irregularly arranged, separated by thick brown walls. Spores $4-5 \times 1.5 \mu$; spore-mass quite colourless; sporophores acicular, $12-15 \times 1 \mu$.

On small twigs of *Populus*. Bromborough, Cheshire (Ellis). Jan.

Distrib. France, Germany.

C. Hendersonii B. & Br. Outl. Fung. p. 322. Cooke, Handb. p. 462. Sacc. Syll. iii. 252. Allesch. vi. 600.

Pustules small, scattered; pycnidium subsimple, thin, sometimes lobed at the margin; contents whitish. Spores oblong, gently curved, hyaline, $7-8 \times 2.5-3 \mu$, issuing in a formless mass.

On twigs of *Rosa arvensis*. Milton, Norths. (Berk.). The dimensions of the spores are taken from the original specimens. A doubtful species.

"Pycnidium nearly regular, but sometimes lobed at the edge, and raised in the centre from the elevation of the subjacent bark. Spores larger than in most *Cytosporae*, oblong, but short, very slightly curved, oozing forth in the form of a dirty-white shapeless jelly." (B. & Br.)

C. Hippophaes Thüm. Fung. Austr. no. 282. Sacc. Syll. iii. 274. Allesch. vi. 583. Died. p. 345.

Stromata small, $250-300 \mu$ wide, scattered, rather prominent, covered by the darkened epidermis, at length erumpent, pallid, then black. Spores $4-6 \times 1-1.25 \mu$; sporophores fasciculate on a basal cell, $12-20 \times 1 \mu$.

On dead twigs of *Hippophaë rhamnoides*. Ayrshire (Boyd). Kew Gardens. Apr.-Nov.

In an Austrian specimen, issued by Thümen, the loculi are circinating and immersed in the bark; the pallid disc is at length pierced by a circle of several ostioles. In the Ayrshire specimens, the loculi may be as many as twelve, all circinating round a central grey or blackish disc, and each piercing it, at least in some cases, by a separate ostiole; the wall of each loculus is distinct and of a pale greenish colour. It is said to be the spermogone of *Massaria Hippophaes* Jacz. (*Sphaeria Hippophaes* Sollm.)

Distrib. Germany, Austria, Denmark.

C. hyalosperma Fr. Syst. Myc. ii. 545. Sacc. Syll. iii. 258.

"Stromata immersed, indistinctly cellular, black, as well as the conico-convex erumpent neck. Spores issuing in a colourless tendril."

On bark of *Acer Pseudoplatanus*. Kew Gardens. A very doubtful species, probably merely a form of one or more which have colourless spore-masses.

In the Kew specimens the spores are slightly curved, about $6 \times 1 \mu$, but the stromata are larger than usual in *Cytospora*. J. B. Ellis's American specimens, named *hyalosperma*, on *Acer rubrum*, are quite different in appearance; the spores are smaller, $4-5 \times 1 \mu$, and they are certainly not the same species. Fries says:—"small, without a depressed disc." Cf. *C. leucosperma*.

Distrib. Sweden, United States of America.

C. Hyperici Grove, in Journ. Bot. 1922, p. 45.

Stromata densely scattered, pulvinate, oval, up to 2 mm. long, convex, opening by a central pore surrounded by a minute

blackish disc, plurilocellate within; loculi more or less circinating, the walls thin and composed of greenish cells, like those of *C. Oxyacanthae* Rab. Spores $4-5 \times 1 \mu$; sporophores rod-like, straight, about $10 \times 1 \mu$.

On dead branches of *Hypericum*. West Kilbride, Ayrshire (Boyd). Sept.

C. intermedia Sacc. Syll. iii. 264. Allesch. vi. 595. Died. p. 357.

Stromata gregarious, pustular, multilocular, the loculi arranged radiately or without order round a central columella, opening by a single black papilla (rarely two) in the centre of a very small cinereous disc. Spores $5-6 \times 1-1.5 \mu$; sporophores occasionally branched at the base, $20-24 \times 1.5 \mu$, or frequently even longer.

On thin twigs of *Quercus Robur*. Kew Gardens. The pycnidial stage of *Valsa in'ermidia* Nits.

Earlwood specimens on Oak tend to show that *Valsa intermedia* Nits. is only a form of *Valsa ceratophora*: if so, *C. intermedia* must be merged in *C. ceratophora*.

Distrib. Germany.

C. Jasmini Cooke, in Grevill. xiv. 4: Sacc. Syll. x. 245. Allesch. vi. 583.

Stromata very loosely gregarious, somewhat conical, subcutaneous, small, covered by the darkened epidermis. Spores $6 \times 1 \mu$, oozing forth through a small orifice in the cuticle.

On thin twigs of *Jasminum officinale*. Kew (Cooke). Apr.

C. juglandina Sacc. Syll. iii. 267. Allesch. vi. 584. Died. p. 345.

Stromata gregarious, covered by the epidermis, which is occasionally cleft by the projecting subcylindrical ostiole, black, plurilocular within, with a distinct columella; loculi circinating. Spores rather straight, $6-7 \times 1 \mu$; sporophores filiform, $10-15 \times 1 \mu$.

On twigs of *Juglans regia*. Kew Gardens. May.

Distrib. Germany, Italy.

C. Kerriae Died. l.c. p. 346. Grove, in Journ.Bot. 1922, p. 45.

Stromata loosely gregarious, tearing the epidermis into laciniae, erumpent, conical, with a blackish disc pierced by one or two pores, irregularly pseudolocellate within; texture dark-olive, a little paler inwards. Spores $6-8 \times 1.5-2 \mu$; sporophores fasciculate, mostly simple, $15-25 \times 1 \mu$.

On dry twigs of *Kerria japonica*. Saltcoats, Ayrshire (Boyd). July.

Distrib. Germany.

C. Kunzei Sacc. Syll. iii. 270. Allesch. vi. 574. Died. p. 351.

Stromata scattered, covered, immersed between the periderm and the cortex, up to 2 mm. broad, multilocular, the loculi

labyrinthiform or irregularly arranged, opening by a single pore (rarely by several pores) in the centre of a minute roundish greyish-yellow disc which alone is visible. Spores $4-5 \times 1 \mu$, issuing in yellow, then saffron-coloured tendrils; sporophores linear, sparingly branched or rather fasciculate at base, 20–25 μ long.

On bark of *Picea excelsa*, *P. pectinata*. Kew Gardens; King's Lynn; Alnwick. Aug.–Oct. The spermogone of *Valsa Kunzei* Nits.

The walls of the loculi are dark brownish-grey in colour; contents dark olive-grey.

Distrib. France, Germany, Switzerland.

C. Lantanae Bres. in Rev. Mycol. 1891, p. 28, pl. 114. f. 6. Sacc. Syll. x. 245. Allesch. vi. 610. Died. p. 367. *Dendrophoma pruinosa* var. *Lantanae* Sacc. Syll. iii. 179. Allesch. vi. 403. *C. pulveracea* Berk. Eng. Flor. v. 283 (?)

Stromata scattered, 250–300 μ diam., black within and multilocular, causing a distinct roundish swelling beneath the epidermis, which finally pushes out, at the most prominent portion, only a minute grey disc, which is surrounded by the torn margin and at length pierced by a black ostiole; walls of the loculi rather thick, of dark olivaceous-brown tissue. Spores $5-8 \times 1-2 \mu$; sporophores verticillately branched, or rather fasciculate on a basal cell, $18-20 \times 2.5 \mu$; branches acute.

On dead twigs of *Viburnum Opulus*, *V. Lantana*, Cheshire (Ellis), Jan.–Apr. On dead branches of *V. Lantana*, Wilmcote, Wk. Sept. On leaves of *V. Tinus*, Apethorpe (Berk.), (?). The spermogone of *Valsa Viburni* Fekl.

Saccardo called it a *Dendrophoma* merely because it has branched sporophores, but that is now known to be true of several species of *Cytospora*. It has no close affinity with *C. pruinosa*. *C. Viburni* Fautr. in Rev. Mycol. 1891, p. 171, is probably only an early state of *C. Lantanae*.

Distrib. France, Hungary, Italy.

C. Lauri Grove, in Journ. Bot. 1922, p. 45. *Ceuthospora Lauri* Sacc. Syll. iii. 279, p.p.; non *Ceuthospora Lauri* Grev.

Pycnidia scattered, conical, truncate, 0.5–1 mm. diam., with a rather large whitish furfuraceous disc at length marked with a minute black pore, dark-olive within, composed (when perfect) of many compact narrow radiately arranged pseudo-locelli or labyrinthiform chambers; walls of the locelli (under the microscope) thick and dark-brown, without a trace of green; no conceptacle. Spores $4-5 \times 0.75-1 \mu$, rather more acute at the ends than is usual; sporophores linear, not very crowded, more or less curved, $10-12 \times 1 \mu$.

On dead twigs of *Laurus nobilis*. West Kilbride, Ayrshire (Boyd). May.

Greville's mistake in calling our "Common Laurel" *Laurus nobilis* was perpetuated by Saccardo (Syll. iii. 279), and has

led to considerable misunderstanding. His specimens were on *Prunus Laurocerasus*, as was well known to his contemporaries: "*Ceuthospora Lauri*," as he called them, is very common, but *Cytospora Lauri* is rare in Britain.

Distrib. Belgium, Austria, Italy.

C. Laurocerasi *Fckl.* Enum. F. Nass. no. 437; Symb. Myc. p. 398; Nachtr. i. p. 27. Tul. Sel. Fung. Carp. ii. 196. Sacc. Syll. iii. 276. Allesch. vi. 593.

Stromata on a rounded base, conical, obtuse, black, slightly locellate within, with a distinct conceptacle; disc round, protruding, cinereous-white, with a black central ostiole. Spores $5-6 \times 1 \mu$, issuing in long slender deep-red or purplish tendrils; spore-mass tinged with purplish-red under the microscope; sporophores acicular or slightly subulate, fasciculate at the base, granular-guttulate, up to $20 \times 1.5 \mu$.

On dead leaves and on branches of *Prunus Laurocerasus*. The spermogone of *Valsa Laurocerasi* Tul.

The form on the leaves does not differ from that on the branches, except that the former is never accompanied by the ascophorous state, as is the latter. This species has been much confused with *C. Prunorum* Syd. and with *C. cincta* Sacc., both of which have longer spores, and belong to different species of the Valsei. It must also be remembered that it is quite different from *Ceuthospora Laurocerasi* Grove, which has pycnidia of a very diverse nature, and no tinge of purple in its spore-mass.

Distrib. France, Germany, Italy, Austria.

C. leucosperma *Fr.* Syst. Myc. ii. 543. Cooke, Handb. pp. 462, 826. Sacc. Syll. iii. 268. Allesch. vi. 567. Died. p. 333. *Naemospora leucosperma* Pers. Syn. p. 108.

Stromata small, widely scattered, $500-750 \mu$ diam., black, raising the epidermis convexly, and at length piercing it by the round flat whitish disc marked with a black ostiole; loculi several, united in the centre, often confluent in a lobed mass; walls rather thick, greyish-green, prosenchymatous; no conceptacle. Spores $4.5-5.5 \times 1.25-1.5 \mu$, issuing in white tendrils; sporophores filiform, often simple, $15-16 \times 1 \mu$.

On twigs and branches of various rosaceous trees, *Crataegus*, *Prunus*, *Pyrus*, *Rosa*, and also on *Acer Pseudoplatanus*, etc. Considered common; summer and winter.

This species is recorded abroad on *Carpinus*, *Cytisus*, *Fagus*, *Ilex*, etc.; but not always correctly, for it differs from its allies in hardly anything but the white tendrils, which show little or no tendency to become yellowish at first. Nevertheless, as is explained below, it is possibly merely a state of *C. ambiens*.

Distrib. Europe, North America.

C. leucostoma *Sacc.* Syll. iii. 254. Allesch. vi. 592. Died. p. 356. *Sphaeria leucostoma* Pers. Syn. p. 39. *C. nivea* "Fckl.", Cooke, Handb. p. 822. *C. rubescens* *Fr.* p.p.

Stromata often crowded, lenticular or conical, up to 1 mm. broad, blackish, immersed, then erumpent (on the larger branches most often transversely), multilocular; loculi (when perfect) narrow, radiating, walls of brown prosenchymatous cells, no columella; disc emerging, flat, snow-white, pierced by one or two black ostioles. Spores $5-6 \times 1 \mu$, issuing in reddish tendrils; sporophores filiform, usually simple, rarely branched, $12-20 \times 1 \mu$.

On bark of *Prunus Cerasus*, *P. domestica*, *P. insititia*, *P. Padus*, and other species of *Prunus*. On *Cotoneaster bacillaris*, Kew (Cooke); a similar form on a dead *Cotoneaster*, Ireland. In some districts not uncommon on cultivated Plums, and a weak parasite. Autumn and winter. The pycnidial stage of *Valsa leucostoma* Fr., which often accompanies it.

In good specimens the round white disc, marked in the centre with a black "eye," is very conspicuous. The spore-mass, when seen in water under the microscope, is distinctly pinkish-red; the fresh tendrils are of the colour called by artists "light-red" not the deep purplish-red of those of *C. rubescens* and *C. Prunorum*. As the *Cytospora*-stage changes into the *Valsa*, the one or two ostioles increase to several less prominent ones. *C. cincta*, also on species of *Prunus*, resembles this species, but has generally fewer loculi and a dingy-whitish disc.

C. leucostoma is stated (Rep. South Afr. Assoc. Adv. Sci. 1915, p. 545) to cause the disease called the "Die-back" of Apple trees, but probably this is a mistake of identification. Cf. *C. rubescens* Tul. and *Valsa Mali* Miy. & Yan.

Distrib. Europe and Siberia.

Stevens (Illin. Agric. Expt. Sta. Bull. no. 217) found a *Cytospora* causing a canker on twig of Apple, which he was inclined to put under *C. leucostoma*, but he did not arrive at a definite conclusion. He found that he could transfer it readily, in pure cultures, from Apple to Pear, Rose, Plum, Peach and *Rubus*, on all of which it grew freely (but not on Cherry or *Acer*). On *Rubus* the pycnidia were smaller.

C. Lonicerae, sp. n. Stromata subsparsa, 200-300 μ diam., rotundata, nigrescentia, immersa, sæpe halone brunneo-rubro cincta, tandem poro atro tantum emergentia (disco obsoleto), intus subunilocularia, vel e loculis paucis rotundis crasse contextis composita; sporulæ hyalinæ, $5-6 \times 1 \mu$, allantoideæ, sporophoris subulatis subsimplicibus $12-15 \times 1 \mu$ suffultæ.

Hab. in ramulis *Lonicerae*, Cheshire (Ellis), Maio.

Distinguished from the spermogonial stage of *Valsa olivacea* Fekl. (Symb. Myc. Nachtr. i. 27) by the minute pycnidia and the much smaller spores.

C. microspora Rabenh. Deutsch. Kr. F. p. 147. Sacc. Syll. iii. 253. Allesch. vi. 578. Died. p. 340. *Naemospora microspora* Cord. Ic. iii. 26, f. 69, p.p.

"Stromata gregarious, raising the epidermis conically; then bursting it by the protruding black disc; texture dark, fuliginous,

within olive-brown, in the upper part in young pustules almost orange-red; loculi incomplete, circinating round a central columella, with a common opening. Spores $6-8 \times 1 \mu$; sporophores rod-shaped, $10-20 \times 1\frac{1}{2} \mu$." (Died.)

On *Crataegus* and *Pyrus Malus*. Cheshire (Ellis). Spores $5-6 \times 1 \mu$, issuing in a white tendril. Spring.

This species is recorded on *Sorbus Aucuparia*, *S. domestica*, and other hosts on the Continent, as well as on those named above. Cooke issued specimens which he named *C. microspora* Cord. var. *Amelanchieris* (on *Amelanchier*, Kew Gardens), but he afterwards transferred them (Grevill. xiii. 96) to *C. microstoma* Sacc. Probably the second name was a slip of the pen. There has been great confusion between *C. microspora* and *Naemospora microspora*, and, as is shown below, *C. microspora* (Corda) Rabenh. should probably be suppressed, and the species arranged under other heads. On account of this, I have preferred to reproduce above merely Diedicke's description.

C. microstoma Sacc. Syll. iii. 254. Allesch. vi. 593. Died. p. 355.

Stromata convex, more rarely conical, with a roundish-oval base, usually $500-650 \mu$ diam., multilocular within, the loculi arranged round the circumference; walls of pycnidial chambers olivaceous-yellow when young; the dingy disc furnished with a single pore (or rarely several). Spores proportionately rather thick, $5-6 \times 1.5 \mu$; spore-mass nearly colourless; sporophores rather thick, branched, about 28μ long.

On branches of *Prunus Laurocerasus*, *P. spinosa* and other species of *Prunus*. Not uncommon. The pycnidial stage of *Valsa microstoma* Nits.

A variety *Cotoneastri* (on *Cotoneaster frigida*) is assigned to this species in Grevill. xiii. 95, and Sacc. Syll. x. 244. It has the pycnidial walls thick, of brown parenchymatous cells.

Distrib. France, Germany, Italy, Sweden, Russia.

C. nivea Sacc. Syll. iii. 260. Allesch. vi. 590. Died. p. 354. *Sphaeria nivea* Hoffm. Veg. Crypt, i. 28 p.p. Non *C. nivea* Fekl.

Stromata gregarious, $500-750 \mu$ diam., between conical and discoid, immersed, then erumpent, black, dark-fuscous within, with numerous small loculi; walls thick and dark; disc emerging, roundish, snow-white, with a central black pore. Spores $6-7 \times 1.5-2 \mu$, issuing in reddish tendrils; sporophores $10-13 \times 1.5 \mu$.

On bark of *Populus nigra*, *P. tremula*, etc., Kew; Hampstead; Sutton Coldfield; Scarborough; Ayrshire, etc. Perhaps rather common, but not so abundant as *C. chrysosperma*. The pycnidial stage of *Valsa nivea* Fr.

Like many species of *Cytospora*, this has been much confused, and is recorded on various trees; but it will be best to follow Saccardo and consider it as confined to *Populus*. The white disc, marked with a black "eye" as in *C. leucostoma*, is sometimes very conspicuous, but, as usual, when the *Valsa*-stage supervenes, the central black ostiole is replaced by a ring of perithecial mouths.

Sydow's specimens (Mycoth. March. no. 2290), on *Prunus Padus*, are *C. leucostoma*.

Distrib. France, Holland, Germany, Italy, Denmark, Siberia, United States of America.

C. occulta Sacc. Syll. iii. 258. Allesch. vi. 568.

"Pycnidia nestling beneath the bark, connate; contents grey. Spores very minute, cylindrical, curved, $6 \times 1.5 \mu$, expelled in golden tendrils from a common tuberculate pore."

On dry branches of *Alnus glutinosa*. Regent's Park (Cooke). Apr. Very uncommon. According to Fuckel it is the pycnidial stage of *Melanconis occulta* Sacc. Cf. *Cytospora diatrypa*, which has not yet been found in Britain.

Distrib. Germany, Denmark.

C. Oxyacanthae Rabenh. in Bot. Zeit. 1858. p. 503. Sacc. Syll. iii. 255. Allesch. vi. 579. Died. p. 339.

Stromata gregarious, but not very crowded, covered, when fully developed hemispherical on a rounded base, swollen, up to 1 mm. diam., bursting irregularly at the summit and showing a small disc, which is at first whitish, then when old blackish, marked with 1-3 inconspicuous black ostioles; loculi numerous more or less labyrinthiform, but frequently arranged in a conspicuously radiating manner; walls dark-grey; central columella black, often very distinct; walls of conceptacle thick and blackish, walls of the loculi composed of a rather thin greyish-green tissue of narrow elongated cells. Spores 6-7 (rarely 8) $\times 1-1.5 \mu$, issuing as a white tendril; spore-mass whitish; sporophores subulate, fasciculate at base, occasionally branched above, $15-25 \times 1-1.25 \mu$ ($10-13 \times 1 \mu$, Died.), springing direct from the prosenchymatous wall at right angles.

On dead twigs, and especially on hedge-cuttings and stakes, of *Crataegus Oxyacantha*. Abundant; Warwickshire; Worcestershire; Cheshire; Ayrshire, &c. Frequently accompanied by a form of *Valsa ambiens* Sacc. No doubt very common, but mostly placed by collectors under *C. leucosperma*. Recorded abroad on *Cydonia*, *Pyrus* and *Sorbus*; also on *Quercus*, but this latter is doubtless a mistake.

The epidermis is swollen by the mass of spores for some distance round the disc, so that the full grown pustules are not conical, but hemispherical. The disc may remain pale and pruinose at the edge. The tissue of the walls of the loculi is unlike that of many *Cytosporas*, being composed of long prosenchymatous grey-green thick-walled cells, about 2.5μ wide, closely resembling those of the leaf of *Hypnum cupressiforme*. By this it is easily distinguished from the otherwise similar *C. ambiens*, which has the walls of the pycnidia composed of thick dark-brown parenchymatous cells. *C. carphosperma* is also very similar, but is distinguished by its host, and by the yellowish colour of the freshly exuded tendrils.

Distrib. France, Holland, Germany, Austria, Italy, Denmark, Sweden.

C. Palmarum Cooke, in: Grevill, xiii. 95. Sacc. Syll. x. 240. Allesch. vi. 587.

"Stromata immersed, then erumpent, loosely gregarious, 0.5–1 mm. diam., at first covered, then cracking the epidermis; loculi few. Spores profuse, $6 \times 1 \mu$."

On petioles and leaves of Palms. Kew Gardens (Cooke). Apr.

C. Pinastri Fr. Syst. Myc. ii. 544. Cooke, Handb. p. 462. Sacc. Syll. iii. 725. Allesch. vi. 575. Died. p. 330.

Stromata on both sides of the leaves, about 250μ diam., more or less globose, immersed, then erumpent, conical, plurilocular, loculi few and imperfect; pycnidial wall of dark brown interwoven hyphæ; disc rounded, tuberculose, blackish, nearly obliterated by the black shining prominent ostiole. Spores $4.5 \times 1.5 \mu$, issuing in a formless milk-white tendril; sporophores fasciculate, acicular or flexuous, $20\text{--}25 \times 1 \mu$, rising from a pale greenish-olive parenchymatous stratum.

On dead leaves of *Pinus sylvestris*. England, Scotland. Not common.

"Loculi irregular, nestling in the parenchyma of the leaf. Disc very prominent, opaque, rugose, then flatter, cinereous-black, with a very prominent ostiole." (Fr.). This species is recorded abroad on *Abies*, *Cryptomeria*, and *Cupressus*; but probably what has been so named on *Abies* is *C. Friesii* (the spermogone of *Valsa Friesii* Fckl.) q.v. A similar form occurs on leaves of *Thuja*, Scotland (Boyd).

Var. **Taxi** Westd. *C. taxifolia* Cooke & Mass. in Grevill. xviii. 73. Sacc. Syll. x. 248. Allesch. vi. 608.

In this variety the stromata are sometimes slightly larger, and occur more often on the upper face of the leaf, splitting the epidermis by the long black ostiole, which stands up conspicuously above it.

On dead leaves of *Taxus baccata*. Carlisle; Rugby; Glamis. Summer.

The spores of the original specimen of *C. taxifolia* are exactly like those of *C. Pinastri*, but the sporophores are shorter. From Shrawley (Worcs.), Dr. J. W. Ellis communicated a specimen, on leaves and twigs of Yew, which differed only in having larger spores ($7\text{--}9 \times 1 \mu$). Cf. *C. Taxi* Sacc. Syll. iii. 271.

Distrib. Europe, North America.

C. Pini Desm. in Ann. Sci. Nat. 1843, xix. 362(?). Sacc. Syll. iii. 270. Allesch. vi. 575. Died. p. 351. *C. pinicola* Westd.; non *C. Pini* Fckl. Fung. Rhen. no. 628.

Stromata scattered, immersed, without any distinct conceptacle, up to 2 mm. diam., the loculi numerous, black, oblong, irregularly circinating; contents greyish-green; disc flat, erumpent, smoky-black; ostiole usually one only, prominent,

black, shining; walls of loculi thin, of dark-brown prosenchymatous cells. Spores $4 \times 1 \mu$, issuing in sulphur-coloured, then lemon-coloured tendrils; sporophores filiform, branched, $20-25 \times 1 \mu$.

On bark of *Pinus sylvestris*. Twycross (Berk.); Cheshire (Ellis). The pycnidial stage of *Valsa Pini* Fr. Westendorp records his form (*C. pinicola*) on *Cedrus Libani*, with spores 6.5μ long. The species is also recorded on *Pinus Strobus* and on *Cupressus*.

The Cheshire specimens have numerous small crowded stromata; disc flat, 0.5 mm. diam. or less, erumpent, smoky black, pierced and in some cases nearly obliterated by a large prominent hemispherical black shining ostiole; spores as above; sporophores somewhat acicular, sparingly branched, acute, $15-18 \mu$ long, colourless and springing from a dusky-olive proliferous stratum.

Distrib. France, Belgium, Germany, Denmark, Dalmatia.

C. Platani Fekl. Enum. F. Nass. p. 52. Sacc. Syll. iii. 267. Allesch. vi. 590. Died. p. 352.

Pycnidia numerous, gregarious, roundish, about 500μ diam., black, raising the epidermis in the form of a tubercle without distinct conceptacle or stroma, divided irregularly into incomplete chambers, walls of clear-brown tissue. Spores $6-8 \times 0.5-1 \mu$, issuing in very slender long flexuous pure-white tendrils; sporophores filiform, longer than the spores.

On the smaller dead branches of *Platanus acerifolia*. Kew Gardens. Apr.

Distrib. France, Holland, Germany, Austria, Italy.

C. pruinosa Sacc. Mich. i. 519. *Sphaeria pruinosa* Fr. Syst. Myc. ii. 486 p.p. *Dendrophoma pruinosa* Sacc. Syll. iii. 179. Allesch. vi. 403. *Cytospora melasperma* Fr. var. *Fraxini* Allesch.

Pycnidia gregarious, immersed, depressed, adnate to the periderm, covered with a greyish pruina, with a bullate erumpent ostiole. Spores hyaline, then yellowish, $5-7 \times 0.5-1 \mu$; sporophores verticillately branched, 4-5 times longer than the spore.

On branches of *Fraxinus excelsior*. Twycross (Berk.).

var. **Ligustri** Strasser, in Verh. k.-k. Zool. Bot. Gesell. Wien, 1900, lx. 311.

Pycnidia globose, unilocular, attenuated into a very short neck, ostiole conico-truncate, but scarcely protruding beyond the pierced periderm, at length collapsing. Spores $5-6 \times 1 \mu$, issuing in olivaceous or greenish-black tendrils.

On twigs of *Ligustrum vulgare*. Regent's Park (Cooke). West Kirby (Ellis). Stevenston, Ayrshire (Boyd). Jan.-Jun.

Strasser places this variety under "*Dendrophoma pruinosa*," which is what Tulasne states to be the spermogone of his *Valsa Cypri* on *Ligustrum*. *Valsa Cypri* also occurs on *Fraxinus*, but the British specimens on *Ligustrum* may not belong to that species.

Distrib. France, Germany, Austria, Italy, Sweden, North America.

C. Prunorum Sacc. & Syd. in *Annal. Mycol.* 1904, ii. 191. *Mycoth. Germ.* no. 136!; *Syll.* xviii. 297. *Died.* p. 355. *C. rubescens* Kalch. in *Bot. Zeit.* 1864, p. 174 (non Fr., quæ *C. leucostoma* saltem p.p.)

Stromata loosely gregarious, conico-truncate, 1-1.5 mm. broad, covered, then erumpent by a transverse fissure, greyish-olive, multilocular round the circumference; disc whitish, marked with a black pore, then becoming blackish; texture of walls indistinct; no conceptacle. Spores $6-8 \times 1.5-2 \mu$, issuing in deep-red tendrils; spore-mass distinctly pinkish; sporophores rod-like, crowded, simple or forked, $22-26 \times 1.5 \mu$.

On branches of various species of *Prunus* (including *Amygdalus*, etc.). Not uncommon. Winter and spring. The pycnidial stage of *Eutypella Prunastri* Sacc.

Differs from *C. rubescens* Tul., with which it was formerly confused, in the longer spores. A form of it has been proved by Frank and by Rostrup to cause the death of Cherry trees. Cf. *Verh. Nat. Ver. Hamb.* 1905, p. 66, and also *C. cerasicola* Sacc.

Distrib. Europe, North America.

C. rhodophila Sacc. *Syll.* iii. 253. *Allesch.* vi. 599. *Died.* p. 360.

"Stromata minute, conico-truncate, with a few spurious loculi radiately arranged, opening by a single central pore. Spores $5-7 \times 1 \mu$; sporophores very slender, rather short ($10-12 \mu$), usually simple, bearing the spores only at the apex."

On dry branches of *Rosa canina*. The pycnidial stage of *Valsa rhodophila* Nits. (n.v.)

Distrib. Holland, Germany.

C. rhoina Fr. *Syst. Myc.* ii. 546. Sacc. *Syll.* iii. 257. *Allesch.* vi. 598.

Stromata scattered, round, $250-500 \mu$ diam., convex, bullate, long covered by the bark, at length bursting it by a slit which afterwards becomes round and wider; contents pallid, then blackish. Spores about 5μ long, rarely issuing in pallid tendrils.

On branches of *Rhus glabra*, *R. radicans*, Kew Gardens, May-Aug. Specimens doubtful.

Forming globose, rather solid tubercles, like a soft sclerotium, with indistinct loculi. Cf. *C. marchica* Syd. in *Hedwig.* 1900, p. (3); Sacc. *Syll.* xvi. 902.

Distrib. Germany, Hungary, Sweden, North America.

C. Rosarum Grev. in *Bail, Syst. Pilz.* p. 81, pl. 14. Sacc. *Syll.* iii. 253. *Allesch.* vi. 600. *Died.* p. 360.

Stromata more or less gregarious, $250-300 \mu$ diam., covered, at last erumpent, conical on a circular base, locellate within and nearly black, surrounded by the epidermis which is occasionally reddened or discoloured, loculi rather few, more or less grouped

round the circumference or sometimes there is only one chamber lobed round the margin; walls of loculi thick and brown; no conceptacle; disc small, greyish, marked with 1-4 shining black bullate ostioles. Spores $4-5 \times 1-1.25 \mu$; spore-mass nearly colourless; sporophores simple, somewhat curved, crowded, or fasciculate at base, $15-20 \times 1 \mu$.

On branches of *Rosa canina*, ? *R. tomentosa*. Scarborough (Masse); Cheshire (Ellis); Ayrshire (Boyd); Hereford. Autumn and spring. Said to be the pycnidial stage of *Valsa Rosarum* De Not. = *V. ceratophora*, var. *Rosarum* Sacc. Syll. i. 109.

Distrib. France, Germany, Italy, Austria, Poland, United States of America.

C. rubescens Tul. Fung. Carp. ii. 187. Died. p. 352. [Fr. Syst. Myc. ii. 542. Cooke, Handb. pp. 462, 821. Berk. Engl. Flor. v. 281. Sacc. Syll. iii. 253. Allesch. vi. 588. All p.p.]

Stromata not crowded, bullate or subdepressed, covered, 1-2 mm. broad; disc erumpent, most often transversely, flattish, dingy, then blackish; loculi numerous, circinating. Spores $3.5-4 \times 1 \mu$, issuing in deep-red tendrils; spore-mass distinctly pinkish under the microscope; sporophores rod-like, usually straight, $15-24 \times 1-1.5 \mu$.

Abundant on bark of *Sorbus Aucuparia*, also on species of *Pyrus*. Winter and spring. The pycnidial stage of *Eutypella Sorbi* Sacc.

Often confused with *C. leucostoma* or with *C. Prunorum*, which also have reddish tendrils. The so-called spermogonial stage of "E. Prunastri" on Apple (Board Agric. Leaflet, no. 87, 1st ed.) is this species.

Distrib. Europe, Siberia, North America.

C. Salicis Rabenh. Deutsch. Kr. Flor. Fung. no. 1340 (1844). Sacc. Syll. iii. 261. Allesch. vi. 603. Died. p. 361. *Naemospora Salicis* Cord. Ic. iii. 26, pl. 4, f. 70, p.p.

Stromata loosely gregarious, convex, blackish, mostly 400-500 μ diam., but sometimes larger, covered by the rarely discoloured epidermis, then erumpent; disc greyish, emergent, pierced by one or more ostioles; loculi confluent, forming a star-shaped or labyrinthiform pallid or grey mass. Spores $4-6 \times 1-1.25 \mu$, issuing in a pallid tendril; sporophores densely crowded, rod-like or subulate, sometimes slightly branched $20-25 \times 1 \mu$.

On dead twigs of *Salix* (*S. alba*, *fragilis*, *pentandra*, *purpurea*, *viminialis*, *vitellina*, etc.) Very common, England, Wales, Scotland, Ireland. Dec.-Aug. The pycnidial stage of *Valsa salicina* Fr.

Spores occasionally longer, 7-8 μ or even more; periderm often shining where discoloured round the disc, which pierces it without tearing it. This species is smaller than *C. fugax*, which has almost no stroma and has more distinct and well-formed

loculi. Nevertheless *C. fugax* is probably only a later state of the same fungus.

Distrib. Europe, India, North and South America.

C. Sambuci *Died.* in *Annal. Mycol.* 1906, iv. 414; *Pilz. Brand.* p. 363. *Smith*, in *Trans. Brit. Myc. Soc.* 1910, iii. 222. *C. Smithiae* *Sacc. & Trott. Syll.* xxii. 958.

Stromata gregarious, up to 1 mm. diam., rather flat, but projecting by a broadly conical mouth, subunilocular or plurilocular, the loculi arranged round a central black columella. Spores $5-6 \times 1-1.5 \mu$; sporophores filiform, simple, up to 25μ long.

On dead bark of branches of *Sambucus nigra*, causing small round dark swellings. Wirksworth, Derbyshire (Gibbs). Oct.

Diedicke describes it as "on elongated bleached patches of the periderm," but there cannot be any doubt that these specimens are the same species as those described by Miss Smith.

Distrib. Germany.

C. Sarothamni *Sacc. Syll.* iii. 272. *Allesch. vi.* 606. *Died.* p. 363. *Ellis*, in *Trans. Brit. Myc. Soc.* 1916, v. 229.

Stromata densely gregarious, tuberculiform, black, depressed-convex, within dark-olivaceous and multilocular, at length opening above by a pore or a minute fissure in the epidermis; disc grey, ostiole black. Spores $7-10 \times 1.5-2 \mu$; sporophores densely crowded, $12-20 \times 1 \mu$.

On rather thick branches of *Cytisus* (*Sarothamnus*) *scoparius*. Darenth (Cooke). Cheshire (Ellis). Feb.-Apr. Said to be the pycnidial stage of *Eutypa macrospora* *Sacc.* The stroma contains numerous small loculi circinating round a central one.

Distrib. Germany, Denmark.

C. Staphyleae *Cooke* in *Grevill.* xiv. 4. *Sacc. Syll.* x. 246. *Allesch. vi.* 608.

Stromata flattened, consisting of two or three loculi, covered by the slightly raised epidermis which opens by a small elevated white-margined pore. Spores $6 \times 1 \mu$.

On branches of *Staphylea pinnata*, *S. trifoliata*. Kew Gardens (Cooke). Apr. A species of which little is known. Cooke has also described a *Cytosporina* (spores $20-25 \mu$ long) on the same host.

C. subclypeata *Sacc.* in *Malpigh.* 1896, x. 273, pl. 6, f. 1; *Syll.* xiv. 917. *Grove*, in *Journ. Bot.* 1922, p. 46.

Stromata scattered, pustular, $500-750 \mu$ diam., swollen, covered by the shining blackish-brown epidermis, grey within and unequally plurilocellate; disc minute, grey. Spores $4-5 \times 1 \mu$; sporophores verticillately branched, $25 \times 1 \mu$, branches acute.

On dead branches of *Rhododendron*. Bidston, Cheshire (Ellis). Ayrshire (Boyd). Edgbaston Botanic Gardens, Birmingham. May-Nov.

In these specimens the epidermis over the pustules is dark reddish-brown, shining especially at the apex when young. Many of the sporophores are rather fasciculate at the base than

branched; spores $3-6 \times 0.75-1 \mu$; spore-mass colourless under the microscope.

Distrib. Siberia.

C. Symphoricarpi, sp. n. Pycnidia sparsa, basi rotundata, conica, $250-300 \mu$ diam., tandem disco minuto orbiculari cinereo poro centrali pertuso erumpentia, intus vix locellata; sporulae allantoides, $4-5 \times 1 \mu$, sporophoris nullis visis.

Hab. in ramulis emortuis *Symphoricarpi racemosi*, Ayrshire (Boyd), Sept. The pore often entirely obliterates the disc.

C. Syringae Sacc. Syll. iii. 272. Allesch. vi. 608. Died. p. 364.

Stromata minute, bursting through the periderm by minute longitudinally arranged fissures, multilocular, the loculi arranged without order, very minute, opening usually by a single pore in the centre of a grey, then fuscous-brown, disc. Spores $5 \times 1 \mu$; sporophores very densely tufted, slightly branched, slender, up to 60μ long.

On branches of Lilac (*Syringa vulgaris*). Apethorpe (Berk.). The spermogone of *Valsa Syringae* Nits.

Distinguished by its very small stromata, which are rather crowded and burst through the periderm by minute pores or chinks or stellate cracks. Berkeley's specimen is exactly similar to Roumeguère's (Fung. Gall. Exs. no. 3970!).

Distrib. Belgium, Germany, Italy, Russia.

C. translucens Sacc. Syll. iii. 261. Allesch. vi. 602. Died. p. 362.

Stromata scattered, very small, blackish, not raising the epidermis much, opening by a single central pore (more rarely by two or three) in a minute whitish dark-margined disc which alone projects, containing within a few radiately arranged loculi or even nearly undivided. Spores $4-5 \times 1.1-2.5 \mu$; sporophores filiform, very slender, up to 40μ long ($5-12 \times 0.5-1 \mu$, soon disappearing, Died.).

On twigs of *Salix babylonica*, etc. Kew Gardens. Spring. The pycnidial stage of *Valsa translucens* De Not.

The disc is at first blackish, but later becomes whitish-grey, beginning in the middle and so leaving the margin dark. The black stromata shine through the translucent epidermis. There seems to be some error in Diedicke's description of the sporophores.

Distrib. Germany, Italy, Denmark, Finland, Russia, North America.

C. Vaccinii Died. Pilz. Brand. p. 366. *C. Myrtilli* Grove, in Journ. Bot. 1918, p. 294.

Stromata scattered, raising the somewhat blackened epidermis conically and piercing it with the blackish disc, about 600μ diam., paler within and pseudo-locellate, with a single ostiole. Spores $4-5.5 \times 1 \mu$; sporophores filiform, fasciculate, mostly simple, $10-15 \times 0.75-1 \mu$ ($30-40 \times 1 \mu$, in the Scottish specimens).

On dead stems of *Vaccinium Myrtillus*. West Kilbride, Ayrshire (Boyd). Mar.

The slightly convex pustules of the cinereous stroma show dark through the epidermis, which is at length pierced at the centre, it may be by a simple blackish ostiole, it may be by a whitish pruinose disc in which lie 1-5 round ostioles.

Distrib. Germany.

EXCLUDED SPECIES.

The four following species, which have been recorded as British, must be excluded from our present list :—

C. macilenta Rob. & Desm. in Ann. Sci. Nat. 1849, xi. 352. Sacc. Syll. iii. 258. Allesch. vi. 565.

This species is recorded “on dry branches of *Acer obtusatum*,” at Kew Gardens, but entirely in error. It normally occurs on *Cornus mas*, and is also stated in books to be found on *Acer Negundo* and *Staphylea pinnata*. But Desmazières afterwards came to the conclusion that the host of his specimens, said in the “Annales” to be *Acer Negundo*, was not that plant, but, as he states on his exsiccatum, “*Staphylea pinnata*,” and, later still, Westendorp decided that they are on, not *Staphylea*, but *Cornus mas*.

C. Ribis Ehr. The only British specimen which I have seen under this name—“On *Ribes*, Swanscombe (Cooke)” —appears to be nothing but *Diplodia*.

C. decipiens Sacc. This species seems to be more likely to be a *Naemospora*. I have seen no specimens, but at any rate, judging by the description, it cannot be a *Cytospora*.

C. stictostoma Grove, in Journ. Bôt. 1916, p. 190.

This species is a *Phomopsis* (*Ph. stictostoma*). The false name was given to it through inexperience; at that time it was not recognised that *Phomopsis* often has a plurilocellate or lobed pycnidium similar to that typical of *Cytospora*.

Cytospora Acharii, *C. flavo-virens*, and *C. stellulata* belong to the genus *Cytosporina*, and must also be excluded.

In addition to these it should be remarked that, in all probability, the following names from those previously mentioned will be suppressed by future mycologists, unless they are adopted in a restricted sense or with a new meaning :—

<i>C. hyalosperma</i>	<i>C. microspora</i>
<i>C. leucosperma</i>	<i>C. guttifera</i>

Even if original type specimens are available, they will be of little use, since many species of *Cytospora* are so extremely like one another. I was first convinced of the truth of this by finding what seemed to be excellent examples of Fries' *leucosperma* on *Acer Pseudoplatanus*; the tendrils, naturally produced, when first seen appeared perfectly white, and the other characters

agreed fairly well; moreover Saccardo has already recorded a form of "*C. leucosperma*" on *Acer campestre*. But, when the branches were kept for some days, the whole of the tendrils turned yellow (almost amber), with just that hint of turbidity which seems to be characteristic of *C. ambiens*, and it became obvious that no distinction worth having could be drawn between this form and what had been already accepted as a form of *C. ambiens* on the same host. This conclusion is strengthened by Saccardo's remark, of his specimens on *Acer* (p. 268) "*basidia verticillato-ramosa, longiuscula.*" Other specimens previously called *leucosperma* on *Prunus Laurocerasus* were found to be similarly capable of falling under the inclusive *C. ambiens*, and for the same reasons. Original examples of Fries (Scler. Suec. no. 156) offer nothing that contradicts this idea.

Very possibly *C. hyalosperma* could be treated in a similar way, and in like manner *C. guttifera* will probably turn out to be merely a congeries of specimens in which, owing to the weather conditions, the gelatinous contents issued in the form of a globule instead of a tendril.

C. microspora Rab. (*Naemospora microspora* Cord.) stands on a different basis: it seems to be merely a mistake. Probably Corda had before him one of those cases, such as are to be met with, where the pustules of a *Cytospora* and of a *Naemospora* grew so close together that they merged into one. I have a twig of *Crataegus Oxyacantha* in which this is clearly shown, the dark stroma of *C. Oxyacanthae* penetrating into, and even being surrounded by, the bright orange stroma of *N. crocea* (Bon.) which is common on that host. The great similarity of the spores, in size, shape, and manner of growth, would help to confirm the illusion. *N. microspora* Cord. (Ic. iii. 26, f. 69) is in my opinion a "species" compounded of two fungi which accidentally grew merged together. The description of *C. microspora* previously given (p. 18) is that of Diedicke, and may represent a species but, I think, it is certainly not that of Corda, Desmazieres or Rabenhorst.

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II.—ISAAC BAYLEY BALFOUR.

The death of Sir Isaac Bayley Balfour, K.B.E., D.Sc., M.D., LL.D., F.R.S., which was recorded in the last number of the *Bulletin* for 1922, is an irreparable loss not only to Botanical Science but to all those who had been privileged to know him and understand his pre-eminent personality and his capacity for realising the really great problems in the world of science. As the son of a distinguished Botanist he inherited a taste for botanical science to which he added the experience of travel and observation, a medical training and a course of botanical studies in Germany, all of which combined with an outstanding attitude of mind enabled him throughout his life to take that larger view which made him one of the most, if not the most, efficient and comprehensive botanist of the Empire, "the friend and counsellor of all that is best in British Botany."

Isaac Bayley Balfour was the son of Dr. John Hutton Balfour, Professor of Botany in the University of Edinburgh (1845-1879) and was born in Edinburgh on March 31st, 1853. He received his early education at Edinburgh Academy and duly proceeded to the University where he graduated D.Sc. in the Department of Physical and Natural Science and also matriculated in the Faculty of Medicine.

In 1874, when he was only 21 and an undergraduate in the latter Faculty, he was selected to accompany the party which went out to Rodriguez to observe the transit of Venus and at this early age he showed full promise of his powers. One of his letters from Rodriguez was considered of such interest by Sir

Joseph Hooker that he communicated it to the Linnean Society, and his observations on the vegetation of the island were published in the Transactions of the Royal Society, vol. 168 (1879), p. 302.

Among the results of this journey may be mentioned a careful study of the genus *Halophila* (Trans. Bot. Soc. Edin., 1877-78), and a valuable monograph of the genus *Pandanus* (Journ. Linn. Soc. Bot. xvii.), a genus of considerable difficulty, based largely on his own observations in the field.

On his return he completed his graduation in Medicine taking the M.B. with Honours in 1877, and then proceeded to the Universities of Strasbourg and Würzburg to continue his botanical studies. In 1879, at the age of 26, he was appointed Professor of Botany in Glasgow, and in 1884 he was elected Sherardian Professor of Botany at Oxford, and in virtue of his office assumed the charge of the Oxford Botanic Garden.

"You sent me to Oxford" he wrote in one of his last letters to Sir W. T. Thiselton-Dyer, and during his short tenure of that office he quickly made his influence felt in reviving the neglected Botanic Garden, and no doubt we may trace back to his Oxford Professorship the development of that interest in Botanic Gardens which has resulted in his remarkable achievements at Edinburgh and placed him on the highest pinnacle of the science and practice of Horticulture. It must not be overlooked, however, that during his tenure of the Glasgow Professorship the main range of Plant houses at the Botanic Gardens was rebuilt and other notable improvements effected which showed his knowledge of the needs of plants and his keen interest in their successful cultivation.

In 1880 he visited the island of Socotra at the instance of the British Association and with funds supplied by that body, and the elaboration of the material he there secured, after a stay of about seven weeks on the island, occupied him fully for some eight years after his return. His systematic work on the flora of Socotra was only equalled by his investigations into economic questions, and he was able to determine the sources of such famous drugs as Socotrine Aloes (*Aloe Perryi*), Dragon's Blood of Socotra (*Dracaena Cinnabari*), known to Dioscorides, and the sources of Socotran Myrrh and Frankincense, whose botanical origin was uncertain. Nor should his discovery of *Begonia socotrana* Balf. fil., be forgotten, since from it have been derived a large variety of most valuable winter-flowering Begonias that now are one of the principal winter adornments of our conservatories. (Trans. Roy. Soc. Edin., Vol. xxxi., 1888.)

While he was at Oxford he rendered two services to Botany for which botanists owe him a lasting debt of gratitude. He was one of the founders of the Annals of Botany and the Editor from the start in 1887 until 1912. Dr. D. H. Scott, who was his colleague in the Editorship for almost 20 years, writes "I consider the Annals owed more to him than to anyone.....he worked all the financial business with the Press most successfully and also

all the plates and I found him the best possible senior partnerHe had an amusing habit of settling everything by telegram—often of surprising length!”

The partnership over the *Annals* worked with absolute smoothness, and the long series of volumes is a sufficient monument to the sagacity and business capacity of Balfour's leading share in the venture.

His other signal service to Botanical Science dating from his Professorship at Oxford was the editing and translating of the standard German Textbooks in various branches of Botany, the publication of which was undertaken by the Clarendon Press. This valuable enterprise was due in great measure to the initiative of Prof. Rolleston in the first instance, and the translation of Sach's textbook of Botany by A. W. Bennett and Sir W. T. Thiselton-Dyer in 1875 was the first fruits of Prof. Rolleston's suggestion. Bayley Balfour took up the task of continuing the work with characteristic energy and was not only responsible as General Editor for the translation of the other standard works which were published by the Oxford Press but also himself translated Goebel's great work on *Organography* (vol. i, 1900, vol. ii, 1905), and with Prof. P. Groom revised and edited the translation of Schimper's *Plant Geography* (1903), and he translated, also with Prof. Groom, Warming's "*Oecology of Plants*" published by the Clarendon Press in 1909.

In 1888 he left Oxford to succeed the late Professor Alexander Dickson as Professor of Botany in the University of Edinburgh, and was appointed King's Botanist for Scotland and Regius Keeper of the Royal Botanic Garden and, as did his father before him, held these posts for a period of thirty-four years until he retired in March last.

These thirty-four years at Edinburgh were indeed remarkable whether one regards his work as a great teacher of Botany or as a great Director of a Botanic Garden. As a teacher for a generation he occupied the foremost place among British botanists. His personal charm arrested the attention of his students and the lucidity and depth of his lectures ensured the maintenance of their interest and attention. Being, as he was, a penetrating observer of Natural History and a remarkably able experimental biologist, he added to all that was valuable in his earlier training the newer knowledge as it was developing and to which he himself was one of the most potent contributors.

His success as a teacher was perhaps due to that wide vision of his which he was able to impart to his students, and which enabled them to realise that botanical investigation and research, whether in the field, the class room or the herbarium, were a means to an end rather than the ends themselves.

And it was not only to the purely botanical students that he thus gave of his best from his vast storehouse of learning and experience "matured by time and ripened by wisdom," but to that great army of medical students who were stimulated,

especially in his later years, by his courses of lectures on such biological topics of the time as relate especially to the medical curriculum.

It was the strain of these large classes of students and his determined endeavour to give to them the best of himself that no doubt proved eventually more than his failing health could withstand. This, added to the strain of the war and the cruel personal loss which it brought him, wore out his strength and in the service of the science he loved so jealously he gave his life in sacrifice and counted himself happy in so doing.

Of his work and achievements as Regius Keeper of the Royal Botanic Garden it is to be hoped a full account will be written. At Edinburgh, as had been the case both at Glasgow and at Oxford, he entered on his Professorship to find a Botanic Garden in a dormant condition which thoroughly whetted his zeal for reform and improvement. He was thus led to create a Botanic Garden, which, when viewed in its many aspects and allowing for the limitations of the space, has not its equal in the British Empire if in the world. Of the greenhouses that Bayley Balfour found at Edinburgh in 1888, the old Palm House—now a Temperate House—and the stove, where Palms and Cycads are now housed, are the only ones that remain. The rest of the fine range of glasshouses, pits and frames are new and constructed in the best possible manner for the growing and display of the remarkable collection of plants he gradually amassed in the gardens.

His activities in reconstruction were equally marked as regards the buildings devoted to teaching, and the last addition to the comprehensive Botanical Institute which he planned and carried to completion was only finished in 1921, just before the meeting of the British Association when the new Laboratory was used for a demonstration of the newly-discovered Devonian fossil plants. His galvanising personality and constructive ability were equally displayed in the open and he entirely reorganised the outside garden. Professor F. O. Bower has so well described this work that we cannot do better than quote his words* :—

“The arboretum was absorbed. Trees 30 and 40 feet high were successfully moved on specially constructed waggons to fresh and suitable sites. The collections of woody plants were enriched, and the herbaceous ground reorganised. But beyond all, the rock garden was created anew on a magnificent scale. This was Balfour's special care. He himself nursed shy plants in favoured crannies on rich schistose soil carried down on his own shoulders from Ben Lawers. His joy in showing them was no less than the pleasure of those who understood the real meaning of his success. It may be said that in the rock garden the true Balfour stood before you. The enthusiastic lover of

* The Glasgow Herald, Dec. 5, 1922.

plants in being: the practical physiologist in the open. His 'oecology' was superior to that usually so called, for it was not analytic only, but constructive. At the back of it all was the fact that as a boy he had passed through the potting sheds like any working gardener. No doubt he had absorbed from Sadler, the old curator, much ancient wisdom; but it was refined and extended by his own scientific and horticultural sense. This, combined with his selection of a highly qualified body of leading officials, won for the Edinburgh garden a special fame for growing shy plants. The cultivation in the garden is probably as good as any in Europe, and it has been carried into many new and experimental lines."

With all this activity in matters connected with the Botanic Garden proper, in addition to his heavy duties as Professor, he yet found time to carry out those researches in the domain of pure botany, both taxonomic, oecological and physiological, which alone would have shed lustre on his name and justified the title of "King's Botanist in Scotland."

His later systematic work dealt more especially with the genera *Rhododendron* and *Primula* and his critical investigations on these genera have given his name a permanent place in the annals of systematic study. His interest in the flora of S.W. China, on which vast subject he was the recognised authority, may have been the reason for his devotion to these complex genera, and their difficulty no doubt added a further incentive to their study. With the *Primulas* collected on the second Mount Everest expedition he was working just before his death, and it is due to his careful studies that we now understand so much of the relationship that exists between the flora of the Himalayas and South Western China.

Of his physiological work mention must be made of his experiments on the effects of freezing in seed germination and of his work on Propagation made available to students in his 'Masters' Lectures on plant propagation, published in the *Journal of the Royal Horticultural Society* (vol. xxxviii. pt. 3, 1913), which show how he brought his wide scientific knowledge to bear on the practical problems of Horticulture.

In the domain of Oecology he was keenly interested, and many years ago he wrote and had printed some sheets of biological notes on Scottish Plants. These were circulated to a few friends, but unfortunately never published, and were only the commencement of what was intended to be a comprehensive work.

He also had in contemplation an account of the development of Botany and Forestry in Scotland during the last fifty years, and much known only to him is now, alas, lost beyond recall. In this connection must be mentioned his keen interest in the proposals to establish an Alpine garden in the Scottish mountains, put forward by Mr. A. K. Bulley, and the attainment of his long-standing desire to obtain a suitable site for a great *Rhododendron*

garden on the west side of Scotland, which he achieved shortly before his retirement.

Of his plans for the future after leaving Edinburgh the following extract from a letter written on April 24th last to Sir W. T. Thiselton-Dyer is of great interest :—

“The new Keeper will have two interesting things to carry out: It was bad luck that I collapsed when the negotiations were on completion. Lord Airlie is allowing us to have the sanctuary of the Caerlochan Deer Forest in which to make an Alpine garden. Bulley is financing. The spot is ideal. How I wish we had such a place going to have taken you to it on one or more of your northern pilgrimages. The other business is—the Forestry Commission offered me as much area as might be necessary in one of their suitable forests for the planting of Rhododendrons. The one I had in view was on the west coast near Ben More. The Rhododendron planting will be quite within easy reach of Glasgow and should be very attractive. This action has, I am glad to say, stimulated the Glasgow Corporation to make more use of the extensive area that belongs to them along the shores of Loch Gail. All this to the good. But I hate to drop out of it just when success is achieved—and indeed but for the engineering of these schemes chiefly I should have bid my adieu at once on settlement after the war with the prospect of a good time in retirement from work. I am trying in bed to arrange papers for a completion of a history of the Edinburgh Botanic Garden—begun many years ago—from which if I achieve it I look for much pleasure and none greater than in the telling of what it owes to you.”

This, as his friends well knew, meant that for him retirement rather than being a time of idleness was to have been one of strenuous work.

Much that he had already done remains unwritten, and it was the hope of Botanists that in his leisure he would have given us of his wide and deep knowledge, illuminated by his grasp of principle and mature judgment, in a treatise on the Flowering Plants which no living botanist could do with so masterly a hand. His Presidential address to the Botanical section of the British Association at Glasgow (1901), was but a foretaste of his unrivalled powers.

To the great regret of his friends the state of his health prevented him from accepting the invitation to serve as President of the Linnean Society in 1916, and this intimation caused them no little anxiety. The Society awarded him the Linnean medal in 1919 and expressed the wish that “he might long be spared to continue the work that has served its members as an example and encouragement.” His death on Nov. 30th 1922 at Courts Hill, Haslemere, has, alas! taken him from us as a living personality, but his work remains, and all that he was will continue as an example and encouragement to those who strive to follow the high ideal he set before them.

III.—HENRY JOHN ELWES.

We are indebted to the Editors of the *Gardeners' Chronicle* for permission to use a very interesting obituary notice of Mr. Elwes which was written by Mr. F. R. S. Balfour and appeared in that journal on Dec. 2, 1922. Except for a few interpolations it is reproduced as originally written :—

In the death of Henry John Elwes on Nov. 26, 1922, at Colesborne, at the age of seventy-six, there passed away one whose name is well and widely known and a figure very familiar to all at Kew. To state that he was perhaps the greatest living traveller of the day, an authority second to no one in Europe on trees, a lepidopterist whose collections enrich our national museum at South Kensington, the author of what is still the authoritative work on Lilies—though published so long ago as 1880, and a big game hunter and ornithologist of great repute, by no means exhausts the list of his activities.

For nearly fifty years Elwes was a valued and regular correspondent of Kew and a generous contributor to the collections. His first gift to the establishment was one of fifteen herbaceous plants on July 18, 1872; his last on August 5, 1922.

After leaving Eton Elwes spent five years in the Scots Guards, but the spirit of adventure which was strong in him to the end caused him to resign his captain's commission and begin that life of scientific travel and adventure from which such a rich harvest has resulted. His journeys were made in Turkey, Asia Minor, Tibet, in India four times, in North America and Mexico three times; in Chile; in Russia and Siberia three times; in Formosa, China and Japan twice; in Nepal and Sikkim. He was the official representative of Great Britain at the Botanical and Horticultural Congresses at Amsterdam in 1877, and at Petrograd in 1884. He was the Scientific member of the Indian Embassy to Tibet in 1886. Few, if any, men knew every country of Europe so well as he, and he greatly benefited by his excellent knowledge of French and German. For nine years Elwes was a member of a wild-boar shooting syndicate in the Ardennes, and he stalked chamois regularly in the Austrian Tyrol.

He was a past president of the Royal English Arboricultural Society, and of the Entomological Society of London; past vice-president of the Royal Horticultural Society, and a Victoria Medallist. In 1921 he was elected president of the British Ornithological Union, having been a member for 55 years. In 1897 the Royal Society elected him a Fellow.

Elwes' first publication appeared in the *Ibis* of 1869, the subject being "The Bird Stations of the Outer Hebrides." Four years later, in June, 1873, he published in the Proceedings of the Zoological Society his paper "On the Geographical Distribution of Asiatic Birds," his most important contribution to Ornithology, and to it he attributed his subsequent Fellowship of the Royal

Society. In 1880 his great monograph on the Genus *Lilium* appeared, a book which has long been out of print, but is still the recognised authority on the subject. From 1880 to 1906 he published 27 papers on the lepidoptera of many regions, and described numerous new species of his own finding. In 1888 there appeared in the Transactions of the Entomological Society his "Lepidoptera of Sikkim," a very valuable record of the numerous species of that country. He was in Formosa in 1912, and succeeded in bringing home alive several specimens of the splendid Mikado Pheasant.

Elwes' botanical discoveries in all the countries he visited were very numerous, and he introduced many species. None of these in recent years have aroused greater interest than the two Southern beeches, *Nothofagus obliqua* and *N. antarctica*, which he introduced from Chile in 1902. Both had been previously in cultivation but had disappeared from gardens almost entirely. The School of Forestry at Cambridge has greatly benefited by his munificence, and owes many of its finest timber specimens to him. In 1900, with his friend, Prof. Augustine Henry, as collaborator, Elwes began the preliminary labours which resulted in the production of that monumental work, *The Trees of Great Britain and Ireland*. The first of the seven volumes appeared in 1906, and the last in 1913. Never before has a book on European trees been attempted on such a scale, and with so lavish an expenditure of money in its preparation. Indeed, it can only be compared with Sargent's *Sylva of North America*, that great fourteen-volume record of American arborescent species. Elwes especially undertook the task of visiting every place in this country where remarkable specimens exist, as well as every European collection of note. The number of trees described which Elwes himself had seen and measured is overwhelming evidence of the untiring zeal he devoted to this work, well-nigh impossible except to one in whom the boyish spirit of adventure survived. The fact that both he and Henry had seen almost every species in its native land gave great additional value to their descriptions of the cultivated plants. Never was a great labour more fittingly divided, Elwes making incessant journeys to see and take particulars of specimens, and Henry, the exact botanist, writing the scientific descriptions. To the writer the ubiquitous character of their researches was vividly brought home when in 1917, during war service in France, he had occasion to visit a little known property in the Médoc. He saw there some remarkable Oaks, Pines, and other trees of the S.E. United States, grown from seeds sent home by Michaux 100 years ago. Though the existence of these trees was scarcely known in France, the proprietor stated that a few years previously two gentlemen had come from London to see them, a Monsieur Elwes and a Monsieur Henri! Some twelve years ago the writer paid a visit to Grasse, in the Riviera, on the business of a public company; Elwes accompanied him solely to see two individual

natural hybrid Oak trees which he believed could be found within a few miles of that place. It is needless to add that the two trees were duly found and photographed on the very day following that of arrival! This is not the place to describe the great book in detail or enlarge on what it has meant for arboriculturists generally. Its scientific accuracy, expressed in plain, straightforward and admirable English, has given an incalculable impetus to forestry and arboriculture in this country, and has inspired with enthusiasm everyone fortunate enough to possess it. Elwes indeed, had a ready pen, and was master of an easy, vigorous style rarely surpassed in botanical literature. No slipshod statement of fact or hearsay evidence would satisfy Elwes' critical faculties; indeed, there are some who think he at times expressed his dissent with needless emphasis. He had little knowledge of the arts of compromise or how to agree with his adversary in the way. When in pursuit of a subject he sometimes urged his views on his hearer without giving him an opportunity to express his own, a failing not uncommon in those of masterful intellect in whom the sense of humour is, perhaps, somewhat deficient. He had difficulty in realising the point of view of others; no one was more ready to acknowledge their achievements in his publications, but the judgments he expressed of the character of men, or the merits of plants, were sometimes precipitate and prejudiced. A charming characteristic was his readiness to admit when he was wrong, and he combined a chivalrous courtesy with a self-assertiveness which those who did not know him well were apt to misjudge. It was only when one had got to know him thoroughly that one appreciated the real charm and loveliness of his character. No sketch of Elwes' life should omit mention of his amazing powers of assimilation of knowledge and of his prodigious memory. He seemed to absorb information through his faculties of vision—both of books and of things—rather than by listening to the spoken word.

As a West Country squire the handsome, burly figure of Elwes was well known, in the hunting field and elsewhere, among his more stay-at-home neighbours. His estate of Colesborne in the Cotswolds is, unfortunately, situated for the most part on the cold oolitic formation of that district, and he deplored, as indeed we all may, that he possessed no acres of green-sand or old red sandstone on which to make his plantations and pinetum. In a frosty valley near his house he formed a "Centenary Plantation" of trees of many species grown from seed collected mostly in this country in 1900, a year remarkable for the ripening of tree seeds of all kinds. Here careful temperature and other records have been kept, and the origin of the trees in each plot is known. It was a delight to Elwes to show his guests the results, and he was as much interested in, and as careful to point out, the failures as the successes. Truth to tell, the former were almost as numerous as the latter. In his garden, however,

he was more fortunate. His glass-houses were full of plants rarely seen elsewhere in cultivation, many of them introduced by himself.

In 1890 his friend Max Leichtlin gave him his collection of South African Nerines. Elwes grew these successfully ever since, and did more than anyone else to improve them by hybridisation. In recent years he took a keen interest in the cultivation of succulent plants, and succeeded remarkably with many species of *Mesembryanthemum*, *Haworthia*, and other desert species. For many years his garden contained a fine collection of bulbous plants; in 1874 he discovered six new Crocuses in Asia Minor, and ever since, with many species of Fritillary, Tulip, and Snowdrops, they have flourished at Colesborne. He had always taken a keen interest in Alpine plants, and near the end of his life contemplated writing a book on these at a time when most of his friends would have preferred him to devote all the energies of his declining years to an autobiography.

Colesborne was a museum of his collections of butterflies, big-game trophies from all countries, and his remarkable collection of timbers, and what he could tell about them, rendered a visit to Colesborne an experience none of his friends will forget. In recent years he devoted much time to the bringing together at Colesborne and the hybridising of sheep of primitive breeds from all parts of these islands, and published an interesting paper about them. He sent pens of these sheep to the Royal Agricultural Show at Bristol in 1913. The qualities of various wools induced him to take up this subject, and from what they learned at Colesborne many have started flocks of their own, and go clad, as he did, in cloth of "Moorit" Shetland, or Black Welsh of their own raising.

Elwes succeeded to Colesborne on the death of his father in 1891. He was the eldest of a family of seven. One of his sisters married, as his first wife, Sir Michael Hicks Beech (afterwards Lord St. Aldwyn), and another was the first wife of the late Frederick du Cane Godman, F.R.S., who shared all of Elwes' botanical and zoological interests, and was his greatest friend. A story Elwes was fond of telling was of when in the 'seventies he and Godman were on a coach on the way to the Yosemite Valley in California. They were sitting on a back seat and named to each other every butterfly and tree they passed. The driver was becoming more irate every minute at hearing two "tender-foot" Britishers identify things of which he knew nothing, unless it was the occasional local name. On coming to a tree of *Fremontia californica*, covered with its yellow blossoms, the lady at his side asked what it was. "I call it Slippery Elm," was his reply, "but I don't know what the pair of bug-fiends back of me will say it is!"

Elwes was at his best in his own home. An admirable host, he imparted information to his guest on all scientific subjects,

with such kindly insistence, that even the most indifferent could not fail to catch his enthusiasm.

He married in 1871, Margaret Susan, the second daughter of the late W. S. Lowndes-Stone, of Brightwell, in Oxfordshire, who, with an only son, Colonel Henry Cecil Elwes, D.S.O., M.V.O., survives him.

Amongst scientific men now living none perhaps had a longer or more intimate acquaintance with Elwes than Sir William Thiselton-Dyer, who became Assistant Director of Kew in 1875 soon after Elwes entered into relationships with the establishment. We are indebted to him for the following communication:—"It is just half a century since I made Elwes's acquaintance when he was a young subaltern in the Scots Guards and I have always thought, at that time, the handsomest man I had ever come across."

"His main life-work lay amongst Birds and Lepidoptera. He was drawn to Botany through horticulture and arboriculture, but never acquired a technical knowledge of Botany. The botanical part of the Monograph of *Liliums* was done by Baker and the scientific side of 'The Trees of Great Britain and Ireland' was the work of Augustine Henry. But Elwes on his part spared neither time, labour nor expense in the effort to attain accuracy in the matters of fact. For instance he went to Busaco in Portugal in 1909 solely to investigate the history of the so-called 'Cedar of Goa,' *Cupresses lusitanica*, which had been introduced from Mexico."

"His paper in 1873 'On the Geographical Distribution of Asiatic Birds' is an important landmark in the literature of Distribution. I quote what I have stated in my article on 'Distribution of Plants' in the eleventh edition of the Encyclopædia Britannica":—

"Of the vegetation of China till recently very little has been known. In 1873, Elwes pointed out (in the paper cited above) that the Himalayan avifauna extended into North-west China and established the Himalayo-Chinese subregion. Shortly afterwards the collection of Prejewalsky confirmed it for the flora. And we know that, excluding the southern tropical area, it has the same character throughout the whole of China proper. We may therefore regard the Himalayan flora as a western extension of the Chinese rather than the latter as a development of the former."

"I well remember Sir Joseph Hooker's excitement when he heard of Prejewalsky's discovery.* It is not surprising that Elwes paid four visits to India and two to China. His establishment of the Himalayo-Chinese region for birds would have alone secured his election to the Royal Society if his achievements in entomology had not also earned it."

* See Thiselton-Dyer, Proc. Roy. Geog. Soc. 1878, on Plant Distribution, and *Mongolia*, Prejewalsky. Translated by E. Delman Morgan, 1876, vol. ii. pp. 85, 87.

"The names of Hooker, Elwes, Bayley Balfour and Prejewalsky will always be inseparably associated with the Himalayo-Chinese region."

Mr. Elwes's intimate association with the Botanical Magazine began in 1875 and continued to the last days of his life. It is not unfitting to note here that largely through his generosity and by his active interest this venerable publication, after a short lapse, has now been launched again on what we all hope will be another century of unbroken prosperity and even greater usefulness. The recently issued part contains a new *Aeschynanthus* from his collections, and several plates in the parts now in the press were prepared from material furnished by him. He had a particular wish that the number of his plants figured in the Magazine should reach a hundred, and it was a great satisfaction to him to know that during this past year the century was attained. In July last he wrote: "I believe I am right in saying that no private garden has contributed so many species to the Botanical Magazine." So long ago as 1877 Sir Joseph Hooker dedicated a volume to him, "an honour," he declared, "which at such an early period I did not deserve." Sir Joseph's fine tribute to the zeal, intelligence and success with which Mr. Elwes had pursued horticultural botany, and to the liberal spirit in which he had laboured to advance its best interests, might have been expressed not only with reference to what he had so far accomplished, but what one having a knowledge of his character and talents might have expected from him during his subsequent life.

A glance at the list of plants which Elwes contributed to the Botanical Magazine reveals the fact that nearly all are herbs, and that rather more than two-thirds of them are petaloid monocotyledons. Many were collected by himself, and chiefly during his travels in Northern India, the Near East, South America and Formosa, a great number being new introductions not a few of which have become garden favourites.

In the issue of the Magazine for May 1, 1875, two of the five plants figured—*Crocus chrysanthus* (t. 6162) and *Galanthus Elwesii* (t. 6166)—were from Elwes, and these were the first of his contributions to the publication. The fine Snowdrop was first collected by Balansa in 1854, and dried specimens were distributed under the name of *Galanthus plicatus*. Elwes introduced it into English gardens twenty years later from the mountains near Smyrna, and was the first to point out its distinctive characters.

Among the plants which Elwes supplied for the Botanical Magazine, the following, arranged in families as in Bentham and Hooker's *Genera Plantarum*, deserve particular mention: Three fine species of *Corydalis*, *C. Sewerzovii* (t. 6896) and *C. Kolpakowskiana* (t. 6925), from Western Turkestan, and *C. Ledebouriana* (t. 6946), from Soongaria; *Tricuspидaria dependens* (t. 8115), of which Elwes brought home seeds from Chile

in 1902; the beautiful *Oxalis adenophylla* (t. 8054), also from Chile; *Deinanthæ caerulea* (t. 8373), a new species of a small genus of *Saxifragaceæ* from Central China, introduced by E. H. Wilson and first flowered in this country at Colesborne; *Caiophora coronata* (t. 8125), a Loasaceous plant with large white flowers, re-introduced from the Argentine side of the Andes in 1902; *Cereus amecamensis* (t. 8277), a fine Mexican species with large white flowers, a plant of which Elwes presented to the Kew collection; though he was much interested in the family this is the only Cactaceous plant received from him for the Magazine; the handsome *Aster diplostephioides* (t. 6718), with flower-heads 2-3 inches across, seeds of which were collected in Sikkim; *Shortia galacifolia* (t. 7082), a lovely plant concerning which Sir Joseph Hooker wrote:—"The credit of flowering it for the first time in England is due to our indefatigable correspondent, Mr. Elwes"; *Primula prolifera* (t. 6732), another introduction from Sikkim, "which had long been regarded as a desideratum"; the singular *Castilleja miniata* (t. 8730), from North-West America, where it was collected by Mr. F. R. S. Balfour; three rather striking *Labiatae*, namely:—*Dracocephalum speciosum* (t. 6281), raised by the Rev. H. Harper Crewe, from Elwes's Sikkim seeds; *Phlomis spectabilis* (t. 8870), a handsome large-leaved plant with rose-purple flowers, from Kashmir; and *Salvia breviflora* (t. 8848), one of Messrs. Veitch's introductions from Western China, and *Nothofagus antarctica*, var. *uliginosa* (t. 8314).

The large proportion of petaloid monocotyledons among Elwes's Botanical Magazine plants has already been mentioned. About a fifth of the whole number belong to the *Orchidaceæ*, and with few exceptions all the Orchids are terrestrial species. These include: *Arethusa sinensis* (t. 7935), from Western China; *Brownleea caerulea* (t. 7309), from South Africa; *Calanthe tricarinata* (t. 8803), from Northern India, Yunnan, and Japan; two fine species of *Chloraea* (tt. 7955 and 8100), tubers of which Elwes brought home from Chile and presented to Kew; the pretty *Coelogyne* (*Pleione*) *Hookeriana* (t. 6388), from Sikkim; *Cypripedium montanum* (t. 7319), from California, and the beautiful *C. guttatum* (t. 7746), from the Altai Mountains; two species of *Disa* (tt. 6529 and 7403), from South Africa; *Habenaria Elwesii* (t. 7478), from the Nilghiri Hills; and the remarkable *Serapias papilionaceolingua* (t. 6255), from Southern France.

The *Scitamineæ* are: *Alpinia Elwesii* (t. 8651), an attractive plant obtained in Formosa; *Hedychium gracile* (t. 6638), from the mountains of Northern India; the splendid *Kaempferia Kirkii*, var. *elatior* (t. 8188), from Rhodesia; and *Zingiber Mioga* (t. 8570), a Japanese species.

Among *Iridaceæ* are four charming Crocuses, *C. chrysanthus* (t. 6162), *C. Crewei* (t. 6168) *C. Fleischeri* (t. 6176, ff. 5-7) and *C. Boryi* (t. 6187) for the introduction of which we are indebted to Elwes; all were collected by himself in Greece or Asia Minor.

Gladiolus Ecklonii (t. 6335), is a distinct and beautiful Cape species. The four Irises contributed include *I. cretensis* (t. 6343), from Greece, Asia Minor, &c., and the magnificent *I. Lortetii* (t. 7251), a Syrian species.

In *Amaryllidaceae*, besides *Galanthus Elwesii* already alluded to, there are an *Agave* (t. 8429), a *Bomarea* (t. 6444), and *Hippeastrum Elwesii* (t. 8614), discovered by Elwes in Argentina.

Elwes's studies of the genus *Lilium* have a lasting memorial in his splendid Monograph of the genus, published in 1880. He was deeply interested in many genera of the family, and altogether twenty-four species, representing ten genera, were contributed by him to the Magazine. Of these may be mentioned *Chionodoxa nana* (t. 6453), *Colchium Troodii* (t. 6901), five species of *Fritillaria* (tt. 6321, 6371, 6385, and 7080). *Kniphofia comosa* (t. 6569), *Muscari aestivale* (t. 6269), and eight Tulipas, these including *T. Eichleri* (t. 6191), *T. Alberti* (t. 6761), and *T. Kaufmanniana* (t. 6887), which are particularly fine species. Some years ago Elwes contemplated a monographic work on the genus *Tulipa*, and it is much to be regretted that he was unable to proceed with it. He was also attracted by the *Arisaemas*, three species of which, including the remarkable *A. Griffithii* (t. 6491), from the Eastern Himalaya, are among his contributions to the Botanical Magazine.

IV.—MISCELLANEOUS NOTES.

LIEUT. S. M. GILBERT, B.Sc. (Agric.), and LIEUT. C. J. LEWIN, M.C., have been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Superintendents in the Agricultural Department, Nigeria.

MR. E. F. L. SHEPHERD has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Botanist and Mycologist, Mauritius.

CAPTAIN E. G. STAPLES has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, a District Agricultural Officer, Uganda.

MR. E. A. WALTERS, formerly Field Assistant, Chemical Research Department, Kenya, has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Agricultural Superintendent, St. Lucia. (See also *K.B.*, 1921, p. 30.).

Visitors during 1922.—The number of visitors to the Gardens in 1922 was 1,143,758.

Garden Operations, 1922.—ROSES. The formal arrangement of beds and clipped hollies south-west of the Palm House was designed by Nesfield and made about 1850. It has ever since been devoted to what used to be known as 'American Plants,' shrubs belonging mostly to the *Ericaceae* and *Vacciniaceae*. The site is low-lying, cold and damp, and plants growing there are very subject to injury by late spring frosts. For this reason many of the shrubs did not succeed and had to be constantly renewed and the general effect was never satisfactory. As all the species grown there are represented in other parts of the gardens, and were not needed for collection purposes, it has been decided to remove them and to transform the area into a Rose garden pure and simple. For many years the marginal beds near the holly hedge have been planted with roses, and these, thriving very well, have been a source of great pleasure to visitors. Considering the extent of Kew and the predominant place roses fill in purely ornamental horticulture at the present time, it was felt that the giving up of this additional area was justifiable. The design has been slightly altered and some of the beds reduced in size. During the past autumn about half the beds have been prepared by thoroughly trenching the ground and by the addition of new soil. These are now planted with varieties which our own experience and that of rose experts suggest will succeed. It is proposed to deal with the remainder of the area next autumn.

THE COLLECTION OF HOLLIES. A considerable extension of the area devoted to this collection has been made during the past autumn. Hitherto the hollies have been planted at each side of the long straight gravel path known as the Holly Walk. This was made in 1874 and is of historical interest as traversing part of the Love Lane of olden times—a bridle path which ran from Richmond Green to the Horse Ferry over the Thames at Brentford. It was also the original dividing line between the old Kew Gardens and Richmond Gardens. As so frequently happens in avenue planting, the hollies were not originally allowed sufficient space to develop fully and they have to be pruned at the side occasionally to keep them from encroaching on the path. There are, however, some very fine specimens amongst them, especially considering the poorness of the soil in which they grow. A new double avenue leading from the steps of the Temperate House across the lawn towards the wood has been made, and others have been planted at the sides of the diagonal walks leading from the same steps.

MEDICINAL AND ECONOMIC PLANTS. A new arrangement of beds for this group of herbs has been made in the garden of Cambridge Cottage, near No. IV. Museum. The design is purely geometrical and is on the lines of the old "Physic Gardens" still to be seen at Padua and other ancient foundations.

The effects of the extraordinary drought of 1921 are still being severely felt. Several old beeches have died and had to

be uprooted and, judging from the poor growth and small leaves produced by many others during 1922, it seems probable that the tale of losses is far from being complete. Although the weather during the latter part of May and early June was hot and dry, the summer on the whole was dull, cool and damp, but the total rainfall has not been quite up to the average, nor has it sufficed to moisten the ground through. In many places it was still, in early December, dry and caked at depths of two to three feet.

Nor is it certain how much the salt water from the Thames (see *Kew Bulletin*, 1922, pp. 13-15) is still affecting the vegetation. Many of the rhododendrons both out of doors and in the Himalayan House have the growth of the past summer scorched and poorly developed. But with the hardy ones at least it is possible that this may in part be due to the after effects of the drought.

It is many years since so plentiful a crop of fruit was produced on hardy trees and shrubs at Kew. Nothing was finer than the common pyracanth (*Pyracantha coccinea*). Judging from our experience at Kew this shrub is not sufficiently grown as a shrub in the open ground, being nearly always planted against a wall, where of course it is also very handsome. But it is perfectly hardy and fruits freely without any wall protection, as a group of the species near the Rock Garden shows. This autumn they were covered from top to bottom with scarlet fruits. Cotoneasters, thorns, whitebeams, mountain ashes, and barberries were all exceptionally good.

The inside of the Aroid House (No. 1) was repainted and some of the woodwork renewed. The interior of the Himalayan House was also repainted.

Thanks in a great measure to the magnificent gift of Orchids by Sir George Holford (see *Kew Bulletin*, 1922, p. 155), there was a very fine display of Cattleyas and Laelias in the Orchid House in late autumn—unfortunately cut short by the November fogs.

One of the most interesting plants which flowered during 1922 was *Pachira macrocarpa*, a native of Mexico, of which there is a fine tree in the Palm House. It is a curious member of the Mallow Family. Some of the flowers developed fruits.

Three special exhibitions were arranged during the year. One illustrating the development of the modern garden varieties of Petunia, another showing the wild tuberous Begonias from the Andes and their modern decorative derivatives, and the third the winter-flowering Begonias of the Gloire de Lorraine type resulting from the cross between *B. Dregei* and *B. Socotrana* and the hybrids between the latter and the tuberous Andean varieties.

ADDITIONS TO GARDENS, 1922. The number of separate consignments of living plants, seeds, etc., to the Gardens was 465. The most important were the following:—

Aberdeen University Botanic Gardens.—*Barleria siamensis*; seeds of *Widdringtonia Whytei*.

- Cambridge Botanic Garden.—Various seeds and plants.
- Edinburgh, Royal Botanic Garden.—297 packets of seeds collected by Mr. George Forrest.
- Glasgow Botanic Gardens.—Collection of Filmy Ferns, etc.
- Glasnevin, Royal Botanic Gardens.—Collection of Peltargoniums, *Crassula rubicunda* miscellaneous Stove and Greenhouse plants, hardy trees and shrubs.
- Royal Botanic Society, Regent's Park.—*Aloe plicatilis*, *Crinum pedunculatum*.
- R.H.S. Gardens, Wisley.—Collection of new Chinese trees and shrubs.
- Arnold Arboretum.—Many packets of seeds, bulbs of *Lilium amabile*, and numerous hardy trees and shrubs.
- Antigua Botanic Garden.—*Cacti*.
- Bangalore Botanic Garden.—Bougainvilleas.
- Calcutta Royal Botanic Garden.—Tubers of *Amorphophallus campanulatum*, seeds of *Dendrocalamus sikkimensis*.
- Darjeeling Botanic Garden.—Large collection of seeds.
- Dominica Botanic Station.—*Utricularia* spp., species of *Lycopodium*, orchids and ferns.
- Kirstenbosch National Botanic Gardens, Cape Town.—95 packets of seeds, South African plants.
- Kumaon Botanic Gardens.—Collection of ferns and orchids; seeds of *Holmskioldia sanguinea*.
- Malta, Dept. of Agriculture.—*Urginea maritima*.
- Mozambique, Dept. of Agriculture.—Crinums.
- Nairobi Forestry Dept.—Seeds *Cassia Beareana*, *Acokanthera longiflora*, and other African plants.
- Nigeria, Dept. of Agriculture, Ibadan.—Seeds of *Elaeis guineensis*, vars.
- Ootacamund Botanic Garden.—Wardian cases of Orchids, seeds, etc.
- Ceylon, Dept. of Agriculture.—Seeds of Tea plant, *Hevea brasiliensis*, etc., Wardian case of Orchids.
- Sierra Leone, Dept. of Agriculture.—Seeds of *Oryza Barthii*.
- Singapore Botanic Garden.—Collection of Stove plants, including species of *Dioscorea*.
- Sydney Botanic Garden.—Seeds and tubers of Australian plants.
- Trinidad Royal Botanic Garden.—*Zephyranthes Eggersii*.
- Uganda, Department of Agriculture (Mr. J. D. Snowden).—Collection of Orchids.
- Washington, U.S. Dept. of Agriculture.—Various new species of economic and other plants.
- Mr. A. C. Bartholomew, Reading.—Herbaceous plants and seeds.
- Mr. F. R. S. Balfour, Dawyck.—Seeds of Chilean plants, etc.
- Mr. H. Clinton Baker, Bayfordbury.—Orchids from Zanzibar.
- Mr. R. N. Beamish.—*Embothrium coccineum*.

Lt. Gen. Sir A. G. F. Browne, Farnham.—*Dendrobium arachnites*, *Sarcanthus filiformis*.

Mr. T. H. Burroughes, Wroxham.—*Rosa Ecae*. Herbaceous plants.

Mr. W. H. Charlton, Shepherd's Bush.—Collection of Succulents.

Mr. L. Chenault, Orleans.—Rare Chinese trees and shrubs.

Major W. F. Chipp, Simla.—Seeds and lily bulbs.

Mr. H. Correvon, Geneva.—Seeds of Alpine plants.

Mr. R. Cory, Cardiff.—Seeds (272 packets) collected by Mr. George Forrest; seeds of *Magnolia parviflora*.

Mr. C. Coutts, Newton Poppleford.—Bulbs and seeds of *Lilium regale*.

Mr. M. T. Dawe.—Seeds, bulbs and tubers from Belgian Congo Territory and Portuguese West Africa; seeds of *Melinis minutiflora*.

Sir Hugh Daly, Ryde.—Indian plants.

Lt. Col. F. R. Durham, Kew.—Seeds and plants from Gallipoli.

Lady Thiselton-Dyer.—*Sedum Winkleri*.

Mr. C. Eley.—7 packets of Azalea seeds.

Mr. H. J. Elwes (late).—Collection of Succulent plants, including *Pelecyphora pectinata*, *Runyonia tenuiflora*, also various seeds and bulbs.

Mr. R. Fox, Penjerrick.—Rhododendrons.

Mr. J. S. Gamble, East Liss.—Bamboos, Himalayan plants and seeds.

Mr. R. H. Graham, Belgian Congo.—Seeds "Efwatakala grass" (*Melinis minutiflora*).

Hon. Vicary Gibbs, Aldenham.—Numerous hardy trees and shrubs, and herbaceous plants.

Mr. A. Grove.—*Lilium Leichtlinii*.

Mr. W. F. Hamilton, Pylewell Park, Lymington.—25 Chinese Rhododendrons.

Commendatore C. Hanbury, La Mortola.—105 packets of seeds.

Mr. F. J. Hanbury, East Grinstead.—Herbaceous plants and seeds.

Capt. J. F. Harrison, King's Walden Bury.—Collection of *Calanthes*, *Begonias*, etc.

Marquis of Headfort.—*Pieris taiwaniana*, *Deutzia taiwaniana*, Chinese Rhododendrons.

Prof. J. Henriques, Coimbra, Portugal.—Bulbs, *Narcissus scaberulus*.

Prof. A. Henry, Dublin.—Seeds of *Larix* and *Widdringtonia*.

Mr. A. Hislop, Rhodesia.—Collection of S. African orchids, etc.

Sir George Holford.—Collection of Orchids (see note in *Kew Bulletin*, 1922, p. 155).

Mr. E. M. Holmes, Sevenoaks.—Seeds of medicinal plants.

Mr. M. Hornibrook.—Collection of dwarf conifers.

Mr. J. Hutchinson, Kew.—23 packets seed of Pyrenean plants.

Emir of Katsina.—Collection of Nigerian seeds.

Dr. Kerr, [Bangkok.—Tubers, *Amorphophallus*; seeds, *Styrax* sp.

Mr. C. H. Lankester.—Bulbs and seeds from Upper Soudan; plants of *Guilielma utilissima* and fern spores from Costa Rica.

Mr. G. W. E. Loder.—Hardy trees and shrubs.

Lady Loder (late), Leonardslee.—Large plant of *Rhododendron Loderi*.

Capt. H. Lynes, R.N., Khartoum.—Seeds and bulbs from Sudan.

Mr. E. L. P. Magor, Lamellen.—Seedlings of Chinese primulas, *Rhododendrons*, etc.

The O'Mahony, Coolballintaggart.—Herbaceous plants.

Miss M. H. Mason, Cape Town.—Tubers of South African *Oxalis* and various seeds.

Mr. J. A. McPherson, Kew.—Collection of New Zealand seeds.

Lt. Comm. J. G. Millais, Horsham.—*Rhododendrons*.

Mrs. M. T. Mitford-Barberton, Kenya Colony.—Orchids.

Sir Daniel Morris.—Seeds of *Melania erythroxylon*.

Mr. W. Nelson, Transvaal.—*Mesembryanthemum Nelsoni*.

Mr. R. Lloyd Praeger, Dublin.—Collection of *Sempervivums*.

Col. D. V. Pirie, Savennières.—Seedling bulbs of *Lilium candidum*.

Mr. W. R. Price, Chepstow.—*Juniperus morrisonicola*.

Mrs. Read, Milford.—Seeds collected by Forrest in W. China.

Mrs. Roberts, Barnes.—Orchids.

Mr. F. M. Rogers, Tanganyika Territory.—88 packets of seeds and Wardian case of plants.

Mr. L. de Rothschild, M.P.—*Nymphaeas*, Chinese *Rhododendrons* and other trees and shrubs.

Mr. C. E. Salmon, Reigate.—*Saxifrages*, etc.

Mr. H. Sclater, Bow.—Collection of succulents, including *Mesembryanthemum fulviceps*.

Mr. Slocock, Woking, Hardy trees and shrubs, including a collection of Chinese *Enkianthus*.

Count Hoyos Sprinzenstein, Austria.—Collection of Tyrolese plants.

Dr. Stephanoff, Sofia, Bulgaria.—73 packets seeds.

Mr. T. P. Stokoe, Cape Town.—Seeds of South African heaths, etc.

Mr. T. A. Stevenson, Sevenoaks.—British Orchids.

Mr. G. Thorncroft, Barberton, S. Africa.—Seeds, bulbs, etc., South African plants.

Mrs. J. A. Tracey, Bogota.—Pita plants.

Prof. R. S. Troup, Oxford.—19 packets of seeds from Kenya Colony.

Mr. W. B. Turrill, Kew.—191 packets of seeds collected in the Balkans.

Mr. P. C. M. Veitch, Exeter.—*Magnolia Veitchii*, and other trees and shrubs.

Messrs. Vilmorin-Andrieux, Paris.—Seeds collected in China by M. Hers.

Mr. F. Kingdon Ward (per Mr. Euan Cox).—169 packets of seeds collected in Chinese Tibet.

Mr. W. T. Webster.—Aquatic plants.

Mr. J. C. Williams, Caerhays.—Numerous seeds and seedlings of Chinese Rhododendrons.

Miss M. Wilman, Kimberley.—South African Plants.

Miss E. Willmott, Warley.—Pelargoniums, etc.

Mr. G. Dent Young, Nigeria.—Seeds of *Dopatrium longidens*.

Sir F. Younghusband (Mt. Everest Expedition, 1922) plants of *Sedum* sp., seeds *Sophora Moorcroftiana*.

Surplus plants from the collections were distributed as usual, either in exchange with botanic gardens, nurserymen, and regular correspondents or as gifts to various teaching institutions, and there was the usual distribution of seeds produced by the cultivated plants; the total number of packets thus distributed was 2533 of hardy trees and shrubs, and 2466 of hardy herbaceous plants. The most important of the seeds obtained for special distribution were: *Canella alba*, *Oryza Barthii*, *Melinis minutiflora* f. *inermis*, *Abies Forrestii*, *Dendrocalamus sikkimensis*, *Picralima Klaineana*, *Fraxinus micrantha*, *Vitis rugosa*.

The recipients of plants, etc., from Kew, included the following:

Birmingham Botanic Garden.—Greenhouse plants.

Bloemfontein Public Parks.—Cuttings of poplars, willows, and tamarisks.

Cambridge Botanic Garden.—Trees, shrubs and cuttings.

Lord Clinton.—Cuttings of poplars.

Director of State Forest Service, Rotoroa, New Zealand.—Cuttings of Willows, etc.

Hon. Vicary Gibbs.—Trees and shrubs, herbaceous plants.

Glasnevin, Royal Botanic Garden.—Nymphaeas, *Sempervivums*, etc.

Mr. C. Hanbury.—Mesembryanthemums, etc.

Imperial War Graves' Commission.—Cuttings, trees and shrubs.

Imperial War Graves' Commission (New Zealand Section).—67 New Zealand Veronicas, Senecios and Olearias.

Liverpool Corporation.—Seeds of *Davidia*, *Aesculus indica*, *Quercus Mirbeckii*.

Mr. F. E. Marshall, Keswick.—58 trees and shrubs.

Municipal Buildings, Aldershot.—2000 cuttings of trees and shrubs.

School of Forestry, Oxford.—Collection of Conifers.

Pomological Institute, Troja, Czecho-slovakia.—Grafts of 94 kinds of *Prunus* and *Pyrus*.

Mr. R. Lloyd Prager.—100 species of *Sempervivum*.

Regent's Park.—20 trees and 100 *Anchusa italica*.

Soldiers' and Sailors' Association, Wimbledon.—150 shrubs.

United States Dept. of Agriculture.—Seeds and cuttings of *Davidia* spp.

Miss E. Willmott.—Rhododendrons and Pelargoniums.

Windsor Castle.—Trees and shrubs.

Purchases of importance :—Cacti collected by C. R. Orcutt, La Jolla, California, in Lower California and Mexico, including a large *Cereus giganteus*, weighing over half a ton and measuring ten feet six inches in height and fifty-one inches in circumference.

At an auction sale of plants of the late Mr. Elwes, some rare orchids and other plants were purchased.

Wardian cases of plants were despatched to :—Uganda Dept. of Agriculture; Amboni Estates, Tanganyika Territory; Ootacamund Botanic Garden; Mauritius Dept. of Agriculture; Mr. M. T. Dawe, Sierra Leone; Singapore Botanic Gardens; Dr. B. Moiser, Sokoto, Nigeria and the Emir of Katsina.

Museums.—The Staff has been actively engaged during the past year in determining and reporting upon a large and extremely varied number of economic products received from correspondents and visitors to the Museums. Questions relating to the identification, origin, and uses of timbers and oil seeds show a considerable increase over former years which appears to indicate that commercial firms are becoming better acquainted with this phase of the activities of Kew.

The facilities offered in the Museums for educational purposes have been put to good use by the London County Council and other educational bodies, for large numbers of school children accompanied by their teachers spent a good deal of time examining the collections during the summer months.

During the year special educational exhibits were brought together on several occasions. These included :—The Effects of Fog and Smoke upon Vegetation; Diseases Injurious to Forest and Fruit Trees; Mud and Sand-binding Plants; and Kitchen and Dairy Utensils made of Home-Grown Woods.

The first-named exhibit directed attention to the deposits of dirt left upon the leaves of plants in the neighbourhood of London and other large cities during winter and the consequent enervating effect upon plant life. This was effected by the aid of sponged leaves contrasted with leaves as collected. In the same exhibit the serious effects of sulphuric acid, from fogs, upon plant life were shown. The disease exhibit illustrated some of the principal insect and fungus diseases with which gardeners and foresters have to cope. Various questions upon coast erosion made necessary the exhibit of sand and mud-binding plants, whilst the great unemployment question created a fitting opportunity for an exhibit of articles made from home-grown timber, thereby showing how woodlands and their exploitation may exert a considerable influence upon rural employment.

As has been the case for many years an exhibit of specimens illustrating British Forestry was made at the Annual Exhibition of the Bath and West and Southern Counties Agricultural Society at Plymouth. As the Forestry Commission now undertake

similar educational work the Director, after consultation with the Forestry Commissioners, decided in the interests of economy to amalgamate the Kew specimens with those of the Forestry Commission and to leave future exhibits to that body. It may here be noted that Dr. J. W. Munro, Entomologist to the Forestry Commission has been given laboratory accommodation at Kew thereby facilitating reciprocity work between the two establishments.

Mr. J. H. Holland of the Museum Staff completed the last volume and index of "The Useful Plants of Nigeria," during the year. This work has an important bearing upon the economic plants of West Africa and towards its completion Mr. Holland has devoted the bulk of his non-official time for the past sixteen years.

Official visits were made by members of the Staff to the Bath and West and Southern Counties Show, the Museums Annual Conference at Leicester, and to Liverpool in connection with questions relating to various economic products.

Donations to the Museums have been acknowledged from time to time in the Bulletin and duplicate specimens have been distributed to the Municipal Museum, Newport; Museum and Art Gallery, Bristol; Royal Museum, Salford, Manchester; Cambridge Road School, Ellesmere Port; &c.

Some progress has been made with checking nomenclature and relabelling in Museum III.

PRESENTATIONS TO MUSEUMS.—The following miscellaneous specimens have been received :—

Mrs. C. Davis, Sandycombe Road, Kew Gardens.—Model of a Bengali village.

Mr. E. L. May, East Molesey.—Nest in wood of Leaf-cutting Bee.

Mr. W. C. Richards, Lonsdale Terrace, Kew Gardens.—Seven photographic views of local interest.

Dr. Hans Schinz, Botanic Gardens, Zurich.—Specimens of *Sarcocaulon rigidum* from South-west Africa.

Mr. R. Swainson-Hall, Victoria, Cameroons.—Eleven samples of woods collected in Portuguese Congo.

Mr. L. St. Clare-Rundlett, Myitkyina, Upper Burma.—Burmese Fan made of wood of *Podocarpus neriifolia* and Chinese Water-pipe.

Mr. J. H. Maiden, Director, Botanic Gardens, Sydney.—Five views of the Botanic Gardens, Sydney.

Mr. N. C. McLeod, Conservator of Forests, Gold Coast.—Sample of Barkcloth prepared from the bark of *Antiaris africana*.

Dr. Moiser, Sokoto, N. Nigeria.—Samples of Materials used locally for dyeing, together with some dyed skins, and a collection of medicinal plants used locally.

The Incorporated Oilseed Association, St. Mary Axe, London, E.C.—Seven samples of oilseeds.

Mr. D. W. Scotland, Director of Agriculture, Sierra Leone.—Decorticated grains of *Oryza Barthii* prepared for food in Sierra Leone.

Mr. P. S. Fowler, Pinit, Ltd., Old Palace Yard, Richmond.—Models of Pinit work in Black Walnut (*Juglans nigra*).

Col. F. Winn Sampson, Tannsfield, Sydenham.—Five mounted specimens of white Ants.

Mr. J. A. Little, The Avenue, Hitchin.—Leaf of *Alnus incana* galled by *Eriophyes brevitarsus*.

Mr. G. E. Bodkin, St. John's Wood, N.W.—Eighteen photographs of the Botanic Gardens, Georgetown, British Guiana.

Mr. Norman Smith, Travancore, Southern India.—Wood of Mango (*Mangifera indica*).

The Hon. Mrs. Smyth, Ashton Court, Bristol.—Door and panel made of Elm.

Acting Colonial Secretary, Bahamas.—Fruits of *Canella alba*.

Mr. M. T. Dawe.—Twenty-one samples of Mayombe timbers, Palm-sling for climbing purposes, made of stems of *Ancistrophyllum* sp. also photographs to illustrate method of using, Portuguese Congo. Double-handed hoe as used by Angola natives on the Malange plateau. Bag and Hat made of leaves of Oil-palm (*Elaeis guineensis*), interior of Angola.

Mr. E. P. Phillips, Division of Botany, Pretoria.—Sample of Coffee, made from the roasted rinds of Prickly Pear.

Miss I. E. Wright, Kew Gardens Road, Kew.—Branch of *Gymnocladus canadensis*.

Messrs. F. Westbury & Son, Great Dover Street, London, S.E.—Stem of Rattan (*Calamus* sp.) from the Malay Borneo Exhibition, Singapore. Placed in Museum No. III.

Mr. E. Hobbs, Southfield Road, Chiswick.—Model in Teak of an Indian Bullock Cart.

Mr. G. Trollip, Cape Town.—A small collection of seeds from Fort Victoria.

Mr. F. Evans, Superintendent of Agriculture, Nigeria.—Hats made at Ekona, Cameroons, from the fibre of *Raphia vinifera*.

Mr. E. Mathieu, Kuala Kangsar, F. M. States.—Samples of Roselle fibre (*Hibiscus Sabdariffa*, var. *altissima*) and *Sida rhombifolia*.

Professor H. G. Greenish, Pharmaceutical Society.—Ninety cabinet specimens of Eucalyptus woods from Australia.

Research in Jodrell Laboratory in 1922.—Mr. L. A. Boodle made experiments on methods of treating plant-fibres for microscopic examination, and began some tests of the longevity of pollen in *Rhododendron*.

Miss M. G. Campin made observations on the chromosomes of the pollen mother-cells in a number of species of the *Solanaceae*.

Mr. R. N. Chrystal was engaged in studies on the life-history and feeding-habits of the *Chermesidae* injurious to Silver Fir and Pine.

Mr. S. Dickinson examined the anatomy of the leaf of Efwatakala Grass (*Melinis*) with special reference to the structure of the hairs and the excretion of oily substances.

Dr. J. W. Munro, Mr. R. N. Chrystal and Mr. R. C. Fisher carried out further experiments on the fumigation of plants with hydrocyanic acid gas with a view to controlling insect pests.

Mr. W. B. Turrill made additional determinations of the chloride content of samples of Thames water and of the water-supply of Kew Gardens in connection with injuries to plants by salt.

Presentations to the Library during 1922.—The most important presentation of the year, as has been the case in many previous years, has been made by the Bentham Trustees, who, in addition to supplying the library with the continuation of several periodicals received in exchange for *Hooker's Icones Plantarum*, have presented it with a complete set of the fine edition of Galen's works by C. G. Kuehn, forming volumes i.—xx. of *Medicorum Graecorum opera*, published at Leipzig, 1821-33. The works of Hippocrates, forming volumes xxi.-xxiii. (1825-27) of this edition of the writings of the ancient Greek physicians, have also been presented by the Bentham Trustees.

The large collection of Sir J. D. Hooker's original correspondence, and other manuscript matter, which was deposited in the library on loan by the late Lady Hooker, has now been presented to the establishment by the Trustees of Sir Joseph's residuary estate. Mr. J. S. Gamble has presented 89 letters written to him by Sir J. D. Hooker during the period 1884-1910.

The Secretary of State for India has presented the reprint of the second edition of J. S. Gamble's *Manual of Indian timbers*, parts 2 and 3 of *The botany of Bihar and Orissa*, by H. H. Haines, and K. Rangachari's *Manual of botany*, ed. 2.

From the Secretary of State for the Colonies have been received several publications of the Department of Agriculture, Mesopotamia, including Administration Report . . . for the year 1921, and *Dates and date cultivation of the Iraq*, by V. H. Dowson, parts 1 and 2, of which a copy has also been received from the publishers of the work, Messrs. W. Heffer & Sons, Cambridge.

From the Gouvernement général de l'Afrique occidentale française 6 publications of the Inspection générale de l'Agriculture, de l'Élevage et des Forêts have been received ; these deal with cotton, the ground-nut (*Arachis hypogaea*), and the oil-palm.

As in former years the library has received liberal contributions from botanical, agricultural and other public institutions, particularly those of the British Colonies and Dominions, India, Java, the Philippine Islands, Japan and the United States of America, and from those of some of the countries of Europe, notably those of Sweden, Denmark, Holland, Belgium, France and Switzerland. To the Agricultural Research Institute, Pusa, the Department of Agriculture, Buitenzorg, Bureau of Science,

Manila, the United States Department of Agriculture and the Smithsonian Institution the establishment is particularly indebted.

Prof. Hans Schinz has presented the third part of the first volume of the botany of *Nova Caledonia*, edited by himself and Mr. A. Guillaumin, and 3 *Mitteilungen aus dem Botanischen Museum der Universität Zürich*.

Dr. N. L. Britton has presented 2 further parts of the *North American Flora*, 11 *Contributions from the New York Botanical Garden*, and the issues during the year of the *Bulletin and Journal* of the same establishment.

From the Director of the Bernice Pauahi Bishop Museum, Honolulu, have been received a valuable contribution to our knowledge of the grasses of Hawaii, by A. S. Hitchcock, forming vol. viii. no. 3 of the Memoirs of the Museum, and the Report of the Director for 1921.

Madame Augustin de Candolle has presented a collection of 13 papers on *Piperaceae* by the late Dr. Casimir de Candolle, and obituary notices of Dr. C. de Candolle and M. Augustin de Candolle.

Mr. J. H. Maiden has published during the year 7 more parts of his colossal work on *Eucalyptus*. In all 56 parts have now been received from him, while 70 parts (69 and 70 during 1922) of his *Forest Flora of New South Wales* have been presented by the Secretary of Agriculture, Sydney.

Lieut.-Col. Sir David Prain has presented bound sets of his *Memoirs and Memoranda*, 1887-1893, and his *Botanical Notes and Papers*, 1894-1901; also about 30 numbers of the *Proceedings of the American Philosophical Society*, 1917-22, *Travaux du Laboratoire de Matière médicale de la Faculté de Pharmacie de Paris*, tome xiii., the year's issues of the *Berichte der Deutschen Botanischen Gesellschaft* and the *Bulletin de la Société botanique de France*, the first volume of *The Forests of India*, by E. P. Stebbing, and several reprints.

Miss E. T. Masters has presented numerous publications that belonged to her father, Dr. M. T. Masters; among them are many of his papers on *Coniferae*, *Malvaceae* and *Restiaceae*, several of which are annotated by him.

Mr. C. G. Lloyd of the Lloyd Library and Museum, Cincinnati, Ohio, who is at present on a visit to Kew, has presented 2 bound sets of the *Bibliographical Contributions from the Lloyd Library*, and a bound copy of volume vi. of his *Mycological Writings*. The first volume of the *Bibliographical Contributions* contains a Bibliography relating to Floras, the names of the authors being arranged alphabetically under countries or groups of countries, while the second and third volumes contain a Bibliography relating to Botany exclusive of Floras. These volumes are not merely a catalogue of the botanical books in the Lloyd Library, which in 1918 contained nearly 48,000 volumes; Mr. Lloyd's aim has been to compile as complete a bibliography of botanical books as is possible, "from all available sources," to produce, therefore, an up-to-date *Thesaurus*

Literaturae Botanicae. At Kew the great usefulness of these *Bibliographical Contributions from the Lloyd Library*, and especially that of the volume relating to Floras, has been repeatedly demonstrated. A complete subject catalogue of botanical literature is badly needed, and we hope Mr. Lloyd will be able to continue to give his assistance towards producing one.

Amongst the publications of societies and institutions presented during the year the following should be mentioned:—*Annales des Epiphyties*, tome vii., from Directeur, Station de Pathologie végétale, Paris; *Annals of the Royal Botanic Garden, Calcutta*, vol. xii. pt. 2 (text and plates), from Superintendent; *Archivos do Jardim Botânico do Rio de Janeiro*, vol. iii., from Director; *Botanical Survey of South Africa*, Memoir no. 3 (*South African Cyperaceae*, by Dr. S. Schonland), from author and Director of the Survey; *British Empire Forestry Conference*, 1920, a complete set of the statements prepared by the Forestry Commission, and *Journal of the Empire Forestry Association*, vol. i., from Secretary; *Contributions from the Osborn Botanical Laboratory, Yale University*, 1920–21, from Director; *Cornell University Agricultural Experiment Station, Memoirs and Bulletins*, from Director; *East Malling Research Station*, 5 papers, from Director; *Harvard Forest Bulletins*, nos. 1–4, from Director; *Indian Tea Association, Quarterly Journal*, from Secretary; *Japanese Journal of Botany*, from the National Research Council of Japan; *Journal of the Arnold Arboretum*, complete set up to vol. iii. no. 1, from Director; *Journal of the Gold Coast Agricultural and Commercial Society*, from Secretary; *McGill University Publications*, series II., Botany, nos. 1–11, from McGill University Library; *Madras Government Museum, Catalogue of the Exhibits in the Economic Products Section*, from Superintendent; *Mededeelingen van de Landbouwhoogeschool* (Wageningen), 7 numbers, from Prof. E. Giltay; *Notes from the Botanical School of Trinity College, Dublin*, from Prof. H. H. Dixon; *Orchid Review*, 1922, from Editor, Mr. Gurney Wilson; *R. Stazione Sperimentale . . . in Acireale, Bollettini and Annali*, from Director; *R. Stazione di Patologia vegetale di Roma, Bollettini* and other publications, from Director; *Recueil des Travaux botaniques néerlandais*, from the Koloniaal Museum, Dreef, Haarlem; *Report of the Australasian Association for the Advancement of Science*, 1921, from General Secretary; *Report of the British Association for the Advancement of Science*, 1921, from Miss E. M. Wakefield; 7 Reports of the Director of the Botanical Survey of India, from Director; *Revue de Botanique appliquée et d'Agriculture coloniale*, from Dr. A. Chevalier; *Review of Applied Mycology*, from Director, Imperial Bureau of Mycology, Kew; *South African Journal of Natural History*, from Secretary; *Station fédérale d'Essais viticoles de Lausanne*, 4 papers, from Director; and *University of California Publications in Botany*, from Manager, University Press, Berkeley.

Other publications received as presentations are :—*Manual of British botany*, by C. C. Babington, edition 10, by A. J. Wilmott, from its publishers, Messrs. Gurney and Jackson; *Manual of Indian botany*, by G. C. Bose, from Mr. S. T. Dunn; *Nigeria handbook*, compiled by A. C. Burns, third issue, from the Crown Agents for the Colonies; *Flora Ibérica: Briófitas*, pt. 1, by A. Casares-Gil, from Director, Imperial Bureau of Mycology, Kew; *The distribution of the vegetation and flora of New Zealand*, by L. Cockayne, from the Trustees of the Cawthron Institute, Nelson, New Zealand; *Illustrations of the British flora*, by W. H. Fitch and W. G. Smith, edition 4, from Dr. A. W. Hill; *Details of specimens of Rhododendrons found by G. Forrest in 1921*, from Mr. J. C. Williams; *The forest flora of New Zealand*, by T. Kirk, 1889 (small paper copy), from Miss Gertrude Fennell; *Census report on the mosses of Ireland*, by Canon H. W. Lett, from Mr. H. N. Dixon; *School botany*, 1854, and *Medical and economical botany*, 1856, both by J. Lindley, from Mr. A. D. Cotton; *Handbook to the natural history of Cambridgeshire*, by J. E. Marr and A. E. Shipley, 1904, from Dr. A. W. Hill; *Ecological studies in the Tong-nai river basin, North Korea*, by R. G. Mills, from Mr. S. T. Dunn; *La Californie et les grands déserts américains*, by P. L. Monnet, from Mr. R. Monnet; *An enumeration of plants hitherto known from Corea*, by T. Mori, from the Government of Chosen; *An Account of the genus Sedum as found in cultivation*, by R. Lloyd Praeger, from the Royal Horticultural Society; *Alphabet of Botany*, by J. Rennie, 1836, from Mr. T. A. Sprague; 89 reprints of botanical papers from the *Annals of Scottish Natural History*, by the late Prof. J. W. H. Trail and others, from Prof. W. G. Craib; *Illustrations of the flowering plants and ferns of the Falkland Islands*, by Mrs. E. F. Valletin, with descriptions by Mrs. E. M. Cotton, from the Editor of *Nature*.

The following have been presented by their authors :—*Studies of the vegetation of the English chalk*, by R. S. Adamson; *Orchidaceae*, by Oakes Ames, fascicle VII; *Die Violeu der Philippinen*, by W. Becker; *Flora of South Australia*, by J. M. Black, part 1; *The ferns of Bombay*, by E. Blatter and J. F. d'Almeida; *Emile Burnat—autobiographie*, by J. Briquet and F. Cavillier; *Plantae Bequaertianae*, by E. De Wildeman; *Beiträge zur Kenntnis der Vegetation und Flora der Seychellen*, by L. Diels; *Das Leben des Malvenrostpilzes in und auf der Nährpflanze*, by J. Eriksson; *Malayan Forest Records* no. 2, by F. W. Foxworthy; Reprints of 97 botanical papers, by F. Gagnepain; *Malay poisons and charm cures*, by J. D. Gimlette, edition 2 (copy also received from the publishers of the work, Messrs. J. & A. Churchill); *The poison plants of Western Australia*, and other papers, by D. A. Herbert; *Hortus Linnaeanus*, by H. O. Juel; *Formosan trees*, by R. Kanehira; *Flora Balearica*, by H. Knoche, parts 1 and 2; *Le piante più notevoli del R. Orto Botanico di Pisa*, by B. Longo; 7 Papers on North African botany, by R. Maire; *Review of the new species of plants*

proposed by N. L. Burman in his *Flora Indica*, by E. D. Merrill; *Flora sylvatica Koreana*, by T. Nakai, pt. XI; *A list of flowering plants from Inner Asia*, collected by Dr. Sven Hedin, by C. H. Ostenfeld and O. Paulsen; *Five years' observations on the biometrics of Southern Nigerian insects*, by the late C. O. Farquharson, edited by E. B. Poulton, from Editor; *Bibliography of the woods of the world*, and *Boxwoods of commerce*, by S. J. Record; *Contribution à l'étude des boissons toxiques des Indiens du Nord-Ouest de l'Amazone*, by P. Reinberg; *Descriptions of three hundred species of South American plants*, by H. H. Rusby; *The natural history of Juan Fernandez and Easter Island*, edited by C. Skottsberg, vol. ii. pt. 2, from Editor; *A simple key to one hundred common trees of Burma*, by C. B. Smales; 41 Papers, chiefly on Orchidaceae, including contributions to *Nova Guinea*, by J. J. Smith; *The centenary of the Royal Botanic Gardens, Peradeniya*, by F. A. Stockdale, T. Petch, and H. F. Macmillan; *A guide to the identification of the more useful timbers of Nigeria*, by H. Stone and H. A. Cox; *A Supplement to F. Hamilton Davey's Flora of Cornwall*, by E. Thurston and C. C. Vigurs, from Mr. Thurston; and *With Lord Byron at the Sandwich Islands in 1825; being extracts from the MS. diary of James Macrae, Scottish botanist*, by W. F. Wilson.

Colonel W. G. King, I.M.S., C.I.E., whose presentation of 842 paintings of Madras and Burmese plants, by the late Mrs. King, was mentioned in *K. B.* 1922, p. 42, has since given to the library a volume containing about 230 paintings in Indian "earth colours" of medicinal plants used by Mahommedans; it was once the property of a "hakeem" of Kurnool, Madras Presidency, and its date is probably about 1854. Miss Macbean has presented a volume containing 213 paintings from nature of plants (mostly introduced) in St. Helena; these paintings were made by her father, General W. Forbes Macbean, in 1848.

Contributions to the Kew collection of drawings of plants have been received from Mrs. Ernest Hart (128 drawings of Japanese plants), Dr. W. Botting Hemsley (numerous published illustrations of species of *Eucalyptus*), Miss Alice Mungo Park (19 water-colour drawings by her sister of plants growing in Madeira, chiefly cultivated), Miss M. Smith (41 plates from Mrs. Valletin's *Illustrations of the flowering plants and ferns of the Falkland Islands*), and from the Royal Horticultural Society (7 original drawings for the *Botanical Magazine* and 12 proofs).

Monsieur F. Gagnepain, in addition to the large collection of his own botanical papers mentioned above, has presented 12 portraits of French Botanists including E. Bureau, G. A. Chatin, M. Cornu, E. A. Finet, A. Franchet, A. F. M. Glaziou, E. Malinvaud, J. B. L. Pierre, J. A. Ramond, B. Renault and E. Roze.

Report of the Herbarium, 1922.—The average number of specimens received at the Herbarium for the five years 1910–1914 was somewhat over 31,000 per annum and during the

years 1920 and 1921 an approximate return to these pre-war figures was reached. The amount of material received during 1922 far exceeded all previous records, the total number of specimens being 60,035.

With the scientific staff still below the pre-war strength the task of dealing even superficially with such a vast amount of material is exceedingly heavy. The naming of the large collections is the work of years, but in pursuance of the policy always adopted by Kew an effort was made to deal as speedily as possible with small collections and individual specimens for name. It is realised that prompt determination of plants of scientific interest or of economic value is of the utmost importance to workers in the Colonies and Dependencies. In spite of the Assistantship for South Africa still being vacant, an attempt was made to meet the most pressing needs of all the African colonies. With a vacancy existing also on the general staff, Australian plants perforce continue unfortunately to be neglected and supplies from that continent have, in consequence, largely ceased to arrive.

COLLECTIONS RECEIVED AND DEALT WITH IN 1922.—The number of specimens received is shown in the following table:—

Collections purchased	- - - - -	6,335
Collections received as donations, or in exchange		53,700
Specimens received in small numbers [name-book entries]	- - - - -	3,350
Specimens for examination received on loan	-	2,353

The number of specimens acquired under the first two headings is 60,035; those under the third heading are not included on account of the large number of common and useless plants they contain. It may be mentioned that the very large figure for this year is chiefly to be accounted for by the presentation of the herbarium of the late Mr. J. R. Drummond by his Executors, although the number of duplicates which it is estimated will be distributed has been deducted. Apart from the Drummond herbarium, however, the figure for 1922 is a record.

The routine work of the year may be summarised as under:—

Specimens poisoned	- - - - -	Approx. 20,000
Specimens laid out and prepared for mounting	- - - - -	16,905
Specimens mounted	- - - - -	23,692
Named specimens incorporated in the Herbarium	- - - - -	26,064
Specimens distributed as duplicates	-	8,619

From this it will be seen that of the 60,000 specimens received during the year, an amount of less than half that number have been put away named in the general collection, and it should be

added that the large number of 26,000 incorporated is partly due to the valuable assistance of volunteers among whom should be specially mentioned Messrs. J. Burt Davy, J. S. Gamble, H. N. Ridley, L. A. Riley and Dr. O. Stapf, who in the course of their private studies have assisted in the naming and laying in of many hundred specimens.

Reference should be made to the cellular cryptogams, of which it is less easy to keep exact returns, and which in consequence are not included in the last set of figures. Large collections of Fungi arrive annually from the Colonies, especially Africa. Owing to the absence of herbaria and lack of literature, workers in the tropics find it an exceedingly difficult, if not an impossible, task to identify Fungi.

The principal collections received are as follows:—

EUROPE.—*Presented*: Britain; Cornwall, by Mr. Edgar Thurston; Orkneys, by Col. H. H. Johnston; various localities, by Mr. C. E. Salmon and Mr. W. B. Turrill; Austria, by Dr. O. Stapf; Kryptogamae Exsiccatae, cent. 26, by Dr. A. Zahlbruckner; Flora Hungarica, cent. 2-5, by Dr. F. Filarsky; Serbia, Bulgaria, Slavonia, Istria and the Karse, by Mr. & Mrs. W. B. Turrill; Gallipoli, by Lt.-Col. F. R. Durham; Greek Macedonia, by Maj. G. W. Harris; Balearic Islands, by L. H. Knocke.

Purchased: Dr. A. Hayek, Centaureae Exsiccatae, fasc. 3, nos. 101-140; H. Sydow, Mycotheca Germanica, fasc. 29-36; I. Nowopokrowski, Russian seeds from the Don District.

ORIENT.—*Presented*: Syria (coll. B. T. Lowne) and Asia Minor (coll. Balansa) by Mr. C. E. Salmon; Palestine, by Mrs. V. E. Buxton.

ATLANTIC ISLANDS.—*Presented*: Madeira, by Miss A. Mungo Park; Azores (coll. T. Carew Hunt), by Capt. G. W. Carew Hunt; Azores (coll. J. A. Brewer), by Mr. C. E. Salmon.

CHINA.—*Presented*: G. Forrest, by the Syndicate which organised the expedition; W. Purdom, by Prof. C. S. Sargent; W. Hancock, by Miss Hancock; Chinese seeds, by Mrs. E. M. Reid.

Purchased: Rev. E. Licent, Tientsin; M. Gandoger, coll. L. Chanet and H. Serre; Rev. J. Cavalerie.

INDIA.—*Presented*: Dehra Dun, by Mr. R. S. Hole; North-Western Himalaya (coll. R. R. & I. D. Stewart), by Mr. R. R. Stewart; Punjab, etc., by Mr. J. R. Drummond; Mount Everest Expedition.

Purchased: Rev. L. Anglade; Madras, Pulney Hills.

MALAY PENINSULA.—*Presented*: various localities, by Mr. I. H. Burkill.

MALAYA.—*Presented*: Siam, by Dr. A. F. G. Kerr; Siam (coll. W. B. Garrett and Luang Winit), by Mr. W. F. Lloyd; Philippine Islands, by Mr. E. D. Merrill and Prof. Oakes Ames; British North Borneo, by Mr. E. D. Merrill; Sumatra (coll. Mrs.

E. M. Burkill and Mohamed Nur), by Mr. I. H. Burkill; Java, by the Director, Botanic Gardens, Buitenzorg.

Purchased : A. D. E. Elmer, Borneo.

AUSTRALIA.—*Presented* : Queensland, by Mr. C. T. White; Western Australia, Swan River, by Mr. A. Cayzer; Northern Territory, between Darwin and Alice Springs, by Mr. C. E. F. Allen.

POLYNESIA.—*Presented* : Svenska Pacific Expedition (coll. C. and Inga Skottsberg), by Dr. C. S. Skottsberg; Fiji, by Mr. W. Greenwood; Hawaiian Islands, by Mr. A. S. Hitchcock.

TROPICAL AFRICA.—*Presented* : Nigeria, Sokoto, by Dr. B. Moiser; Nigeria, by Mr. John Dent-Young; Gold Coast, by Dr. J. M. Dalziel and N. C. McLeod; Cameroons, by Mr. G. L. Bates; Angola and Portuguese Congo by Mr. M. T. Dawe; Sudan, by Maj. Guy Aylmer; Upper Sudan, Mongalla Province, by Mr. C. H. Lankester; Uganda, by Mr. J. D. Snowden; Kenya Colony, by Mr. R. A. Dümmer, and Mr. E. A. Walters; Rhodesia and the Congo Region, by the Rev. F. A. Rogers and Mr. J. Burt-Davy; Rhodesia, (coll. F. Eyles), by the Division of Botany, Pretoria; Rhodesia (coll. J. A. S. Walters), by the Department of Agriculture, Rhodesia, and (coll. Dr. R. E. Fries), by H. O. Juel.

Purchased : R. A. Dümmer, Kenya Colony, Great Rift Valley.

SOUTH AFRICA.—*Presented* : Griqualand East, by Miss M. Wilman; various localities, by the Division of Botany, Pretoria, Mr. H. G. Fourcade, Mr. J. Burt-Davy and the Rev. F. A. Rogers.

NORTH AMERICA.—*Presented* : Greenland (coll. A. C. Seward and R. E. Holtum), by Prof. A. C. Seward; Nova Scotia (coll. M. L. Fernald and B. Long), by Dr. B. L. Robinson; specimens cultivated in the Arnold Arboretum, by Prof. C. S. Sargent; Reliquiae Farlowianae, by Dr. R. Thaxter; Western United States (coll. J. B. Leiberger), by the U.S. National Museum; Californian grasses, by Lt.-Col. H. H. Wolley-Dod; United States Fungi, by Mrs. Flora W. Patterson.

Purchased.—B. F. Bush, Missouri.

CENTRAL AMERICA.—*Presented* : Mexico (coll. G. Arsène), by the U.S. National Museum; Yucatan (coll. G. F. Gaumer & Sons, by Dr. C. F. Millspaugh.

WEST INDIES.—*Presented* : Jamaica, by Dr. Janet R. Perkins; Trinidad, etc., by Dr. N. L. Britton; Cuba, Havana and Pinar del Rio, by Dr. C. F. Millspaugh.

Purchased : Miss M. H. Shaw, Barbados and other Algae.

SOUTH AMERICA.—*Presented* : British Guiana grasses, by Mr. A. S. Hitchcock; Colombia (coll. E. André), by Bentham Trustees; Fungi (coll. Dr. J. N. Rose), by Mrs. F. W. Patterson.

GENERAL.—5089 miscellaneous plants, by the Muséum National d'Histoire Naturelle, Paris.

Mr. Edgar Thurston, C.I.E., who presented his herbarium of Cornish plants to Kew in 1919, has added to it the specimens collected by him and his co-workers during 1921. Col. H. H. Johnston, C.B., has continued his investigation of the Flora of the Orkneys and presented his recent discoveries. Interesting collections made by Lt.-Col. F. R. Durham, O.B.E., M.C., Major G. W. Harris and others in the nearer East have been received and a detailed report on them published in the *Bulletin*, 1922, pp. 291-298. Mr. and Mrs. W. B. Turrill have presented the specimens and seeds collected by them during their recent tour through the Balkan Peninsula. Various British and Oriental plants, including some additional ones collected in Syria by Mr. B. T. Lowne, have been presented by Mr. C. E. Salmon, F.L.S. The valuable collection of Azores plants made by Mr. T. Carew Hunt between 1844 and 1848 has been described in the *Bulletin*, 1922, p. 47; a collection made by Mr. J. A. Brewer in the same islands has been presented by Mr. C. E. Salmon. With regard to China, the presentation of Mr. G. Forrest's collections from N.-W. Yunnan and S.-E. Tibet has been recorded in the *Bulletin*, 1922, p. 174. The collection made around Tientsin by the Rev. E. Licent and that from Northern Yunnan, by the Rev. J. Cavalerie have been acquired by purchase. The Chinese herbarium of the late Mr. W. Hancock, F.L.S., has, according to his wish, been presented, to Kew by his sister, Miss Hancock, and at his desire the duplicates are being sent to the University of Bristol. (See *Kew Bulletin*, 1922, p. 204). Mrs. E. M. Reid having obtained, in connection with her work on fossil fruits and seeds, some Chinese seeds has kindly presented a set of them.

The Indian herbarium of the late Mr. J. R. Drummond, B.A., F.L.S., from the Punjab and other parts of India presented by his Executors, containing about 30,000 specimens is being dealt with at Kew, and is a most valuable acquisition. The plants collected during the Mount Everest Expedition, 1922, have also been presented to Kew by the Mount Everest Committee, and are now being worked out. Various collections made in Siam by Dr. A. F. G. Kerr, Mr. W. F. Lloyd, Mr. W. B. Garrett and Luang Winit have been received as well as specimens from lower Siam and the Malay Peninsula from Mr. I. H. Burkill, M.A., F.L.S. Philippine orchids have been presented by Prof. Oakes Ames and nearly 3,000 other plants from the same islands and Borneo by Mr. E. D. Merrill, Sumatran plants collected by Mrs. E. M. Burkill and Md Nur have been sent by Mr. I. H. Burkill.

The only Australian collections received have been those presented by Mr. C. E. F. Allen which he collected on a journey from Darwin to Alice Springs, various Queensland plants which have been received from Mr. C. T. White, and specimens from Mr. A. Cayzer from Western Australia.

Mr. W. Greenwood has sent fresh instalments of the plants collected by him in Fiji. From Dr. C. Skottsberg specimens have

been received collected by him and Mrs. Inga Skottsberg during the Svenska Pacific Expedition.

Dr. B. Moiser, Principal Medical Officer, Sokoto, Nigeria, has sent interesting collections from the Sokoto district of Nigeria and Mr. M. T. Dawe, F.L.S., has sent large collections from Angola and the Portuguese Congo. Major Guy Aylmer has presented his collection from the Sudan and Mr. C. H. Lankester one made by him in the Mongalla Province, Upper Sudan. The Rev. F. A. Rogers, M.A., has continued to send specimens collected by him in the Congo Region and Rhodesia. A collection made by Mr. F. Eyles in the latter region has been presented by Dr. I. B. Pole-Evans, C.M.G. Plants from Griqualand East have been presented by Miss M. Willman, and from other parts of South Africa by Dr. I. B. Pole-Evans, Mr. J. Burt-Davy, F.L.S., Mr. H. G. Fourcade and the Rev. F. A. Rogers.

Lt.-Col. H. H. Wolley-Dod, R.A., has sent over 200 grasses collected by him in California, and Prof. C. S. Sargent, LL.D., has presented specimens of over 300 plants cultivated in the Arnold Arboretum. Cryptogams left by the late Prof. G. Farlow have been presented by Dr. R. Thaxter.

Dr. C. F. Millspaugh has presented a set of specimens collected in Yucatan by Mr. G. F. Gaumer and his sons, and also some collected in Cuba, Havana and Pinar del Rio by Mr. H. A. van Hermann. Dr. N. L. Britton and Dr. Janet R. Perkins have sent collections from various West Indian Islands. A set of Barbados Algae named by the late Dr. Bornet has been purchased from Miss M. H. Shaw. Specimens of some of the families not contained in the herbarium of the late E. André when it was presented in 1912 have now been acquired from his son, Mons. R. E. André and presented by the Bentham Trustees.

To the Muséum National d'Histoire Naturelle, Paris, Kew is indebted for a collection of over 5,000 specimens from various localities.

Visitors.—About 3,700 visits have been made to the herbarium during the year. Amongst those who have paid frequent visits or have made a prolonged stay may be mentioned:—Prof. Oakes Ames, Cambridge, Mass. (Orchidaceae); Mr. E. G. Baker (British Museum) African; Mr. and Mrs. A. F. Broun (Sudan plants); Mr. N. E. Brown (South African and South American plants); Dr. A. H. R. Buller, Winnipeg (Canadian and British Fungi); Mr. and Mrs. J. Burt-Davy (Transvaal plants); Mrs. Agnes Chase, Washington, D.C. (American Gramineae); Mr. S. Dickinson (British Fungi); Mr. H. N. Dixon, Northampton (Musci); Mr. W. Fawcett, British Museum (West Indian plants); Mr. J. S. Gamble (Flora of Madras); Mons. F. Gagnepain, Paris (Indo-Chinese Euphorbiaceae); Mr. H. H. Haines (Flora of Orissa and Behar); Mr. L. Hall (Plant Chemistry); Prof. A. Henry, Dublin (Conifers); Mr. W. O. Howarth, Manchester (Gramineae); Mr. L. V. Lester-Garland (Australian plants); Mr. C. G. Lloyd, Cincinnati (Fungi); Mr. E. W. Mason, Imperial

Bureau of Mycology (Fungi); Dr. C. F. Millspaugh, Chicago (Euphorbiaceae); Mr. J. Parkin (Phylogeny); Mr. W. R. Price (Formosan plants); Mrs. E. M. Reid and Miss M. E. J. Chandler (fossil fruits and seeds); Mr. H. N. Ridley (Flora of Malay Peninsula and Islands); Mr. L. A. Riley (South American plants); Rev. F. A. Rogers (Tropical and South African plants); Prof. Seiya Ito, Sapporo (Japanese Fungi); Dr. Perley Spaulding, Washington (Forest Pathology); Dr. O. Stapf (Tropical African Gramineae and Botanical Magazine); Prof. D. Thoday (South African Thymelaeaceae); Mr. Edgar Thurston (Cornish flora); Dr. W. Trelease (Piperaceae); Dr. J. G. Walker, Madison, Wisc. (pathology); Mr. E. H. Wilson (Chinese plants).

In addition to the above, the staff employed on the compilation of the Royal Horticultural Society's new edition of Pritzel's Index Iconum, under the direction of the Editor, Dr. O. Stapf, has been accommodated in the Herbarium and the preparation of the Plates and text of the Botanical Magazine has also been carried out mainly in The Herbarium and Library.

Peradeniya, New Laboratories. — In *Kew Bulletin*, 1922, p. 207, in commenting on the centenary of the Royal Botanic Gardens, Peradeniya, Ceylon, reference was made to the long and interesting record of research which had been carried out not only by the resident staff of the Department, but also by many well-known visitors.

It is therefore very gratifying to learn that the special attention which H.E. the Governor, Sir William Manning, has devoted to the prosecution of the agricultural interests of the country has resulted in the erection and equipment of two up-to-date laboratories for Entomology and Mycology and the necessary quarters for the staff.

On the occasion of the opening of these new laboratories by His Excellency in October last, the Director of Agriculture, Mr. F. A. Stockdale, referred to the past excellent work that had been carried out there with such meagre accommodation and equipment. It had been a great achievement, and with this handicap removed they were now a long way towards meeting any emergency which might arise to threaten the important agricultural interests of the country.

The importance of adequate properly equipped laboratories in connection with the large botanical and agricultural establishments of the Empire in the Tropics cannot be over-estimated. The majority of the problems affecting tropical plant life can only be investigated amid their natural conditions of growth, and it is all the more important that not only the permanent staffs of Colonial Departments are enabled to work out these problems under suitable conditions, but that visitors travelling with the intention of investigating special problems also have all possible facilities to aid them. The completion of these new laboratories at

Peradeniya, with that opened in 1921 at the Botanic Garden, Singapore, forms two more important links in the chain of stations throughout the Empire where plant life can be investigated under the most favourable conditions.

An account of the opening ceremony and photographs of the two new laboratories appeared in the *Tropical Agriculturist*, November 1922.

Fruiting of *Ginkgo biloba*.—In continuation of the article on "The Fruiting of *Ginkgo biloba*" which appeared in *K. B.* No. 9, 1922, pp. 262-265, information has recently been received from Mr. J. D. Halliburton, Superintendent of Parks, Bath, of the fruiting of a tree during 1922 at "Glenfield," Western Park, Bath, the residence of the Rev. Frederick N. Carus-Wilson. The tree was planted as a sapling about 1870. It is now about 40 ft. high and the trunk girths 3 ft. 9 ins. at 3 ft. from the ground. The spreading habit, as far as can be judged from a photograph, is identical with that of well-known male trees, thereby disproving the theory that a variation in habit exists between male and female trees. As it stands 400 yards from the nearest male tree pollen must be carried a considerable distance if the species is not parthenogenetic as has been suggested. As, however, pollen is borne in abundance there is no reason why it should not be carried that distance by wind or insects. The tree is said to have borne a good crop of seeds.—W. D.
